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CIVIL ENGINEERING.

On the Introduction of Constructions to retain the sides of deep Cuttings in Clays, or other uncertain soils. *By* PROFESSOR HOSKING.

(Paper read at the Institution of Civil Engineers.)

Deep cuttings are not only expensive, but their sloped sides are in most soils so uncertain, and subject to so many contingencies—involving unforseen outlay, as well as danger to the works, and incidentally to human life also;—that any mode of operation which would have the effect of rendering them more secure, though the original expense were not reduced, would be deserving of consideration; but if it can be shown that perfect security can be obtained at reduced cost, the consideration becomes even more interesting. The expense of the first formation of a cutting under given circumstances is easily calculable, and so is the time within which the work may be effected. Experience has proved that there is, for every soil, a limit in depth, beyond which it becomes more expedient to drift the required way, and construct an arched tunnel of sufficient dimensions, than to make an open cutting with the requisite slopes. Even when the first cost would not decide the question, the preference is, nevertheless, often given to the tunnel because of the greater security of constructed work, than of the sides of an open cutting. There is, indeed, in practice, a considerable range, within which it has always been uncertain whether—taking all things into consideration in each particular case—tunneling or open cutting is the fitter expedient, and it is in this intermediate range that something seems to be desirable which has not hitherto been practised.

A tunnel, it may be remarked, is expensive, not from the nature and extent of its construction, but from the circumstances in which those constructions must be executed. The mere constructions are less than would be consumed by common retaining walls to the sides of a cutting, not deeper than the eighth of an ordinary railway tunnel. The several parts of a tunnel derive support from each other, which is not the case with ordinary retaining walls, whose efficiency depends wholly upon the resistance which their own mass, or weight, and extent of base, enable them to offer to the pressure of the body to be retained. If to two opposite retaining walls, be given sufficient means of assisting one another, they may be at once reduced to one-third of the bulk they require without such assistance, and would then be as safe as the sides of a constructed tunnel, the strength of which is only limited by the power of the setting material employed in the work, to resist compression.

Before proceeding to the consideration of the means of enabling opposite retaining walls to assist each other, it may be worth while to consider, whether retaining walls are generally constructed in such a manner as best to adapt their components to the duty to be performed. No one would place a buttress intended to resist the thrust of an arch within the springing walls, or under the arch whose thrust is to be resisted; yet in the construction of retaining walls the counterfort is placed on that side which receives the pressure, where its utility is very questionable, except to keep the retaining wall from falling back against its load, which, from the transverse section too generally given to such walls they would be apt to do, if they were not so propped up by their counterforts. Wharf and quay walls, and the revetment walls of military works, may require a fair face, unbroken by projections in front, but this is not the case with retaining walls for roads and railways, where a long line of projecting buttresses would be unobjectionable, the counterforts becoming buttresses and merely changing places with the wall. On account of the common practice of battering the faces of retaining walls in curved lines, and of radiating the beds of the brickwork composing them from the centre of curvature in every part, the back of the wall must contain more setting material than the face, with the same quantity of solid brick; that is, if the work be bonded through. Hence the back of the wall will be more liable to compression and settlement than the face. Counterforts must be built in the same courses, and consequently must have still thicker beds of compressible mortar than the wall, or the bond between the wall and its counterfort must be dropped, and the counterfort thus become utterly inefficient. Perceiving the fallacy of the back counterforts as an aid to the retaining wall to resist pressure from behind, the author designed a retaining wall a few years ago, with greater substance in itself than the usual practice would require, but without back counterforts. The wall was substantially of brickwork, with concrete coffered in the heart, to give mass and weight without the expense of solid brickwork; the concrete being in layers of 30 inches thick, separated from one another by two thorough courses of brickwork in every twelve courses in height. The wall was battered in face upon a curved line, and had radiating courses of

brickwork; but the arrangement spoken of, gave the means of making the longer line of the back of the wall with bricks instead of mortar, by inserting within the height of each coffer at the back, an additional course of brickwork; and the whole construction was well tied together, both longitudinally and transversely, with hoop-iron laid between the thorough courses of brickwork.

The retaining walls, in the cutting upon the line of the extension of the London and Birmingham Railway, from Camden Town to Euston Square, are designed according to the common practice; they are built wholly of brickwork in radiating courses, and with counterforts following their own contour. In this case the centre of gravity of the wall falls wholly behind its base; and the counterforts, not commencing until the wall has reached one-third its height, render it still more dependent for support upon the ground it is intended to retain. It is well known that these extensive walls, though furnished with all the collateral works necessary to protect them from exposure to undue influences, and although set nearly one-fourth of their height in the ground, have failed to a considerable extent. A system of strutting with cast-iron beams, across from the opposite walls, to make each aid the other, has been applied to meet the exigency (plate I, figs. 1 and 2;) but this is limited to the upper parts of the walls, and the author thinks it may yet be found that the toes of the walls will require to be strutted apart, or otherwise fortified.

Abutting struts, from opposite walls, occurring at intervals only, leave the intermediate portions of the walls exposed to pressure from behind without support, unless these intermediate portions are so disposed, as to communicate the pressure upon them to the struts. Hence, a common retaining wall, abutted at intervals, would require these intervals to be more or less distant, in proportion to the strength of the wall between them. Instead, therefore, of a continuous wall on each side of the cutting, the author suggests (plate I, figs. 3, 4, 5, and 6,) that buttress walls should be placed at intervals, opposite to one another, and strutted apart at their toes by an inverted arch, and above, at a height sufficient for whatever traffic the cutting is to accommodate, by a built beam of brickwork, in vertical courses, supported on an arch, and prevented from rising under the pressure by an invert upon it. This built beam will then be, as it were, a piece of walling turned down on its vertical transverse section, and will resist any pressure brought upon it through the buttress walls, to the full extent of the power of such a wall built vertically, to bear any weight laid upon its summit; the pressure would be applied, in the line of the greatest power of resistance, and there would be no tendency to yield, except to a crushing force. Let such transverse buttress walls, so strutted apart, with the road between them, be the springing walls of longitudinal counter-arched retaining walls, which, being built vertically and in horizontal courses, but arched in plan, against the ground to be retained, will carry all the force exerted against them to their springing walls, and the springing walls or buttresses will communicate, through the struts, the power of resistance of each side to the other and thus insure the security of both. This arrangement may be carried to any extent in height, by repeating the abutting beam or

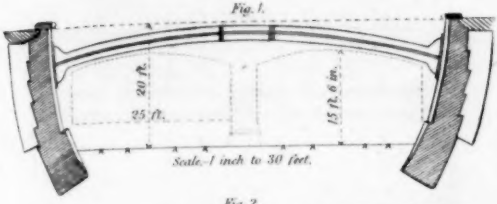
strut at such intervals as the thrust to be resisted and the strength of the buttress-springing-walls may require.

It will be admitted, that whatever insecurity there may be in the sloped sides of a cutting, it becomes greater as the depth is increased, the inclination being the same; so that a slope of 40 feet in vertical height is not deemed so trustworthy as a similar slope in the same place of 20 feet in height, and, indeed, to give the same degree of security, as the height increases, the inclination of the slope must be increased. Consequently, the expense of a cutting with slopes increases even in a greater degree than the mere additional depth would require, and if it can be shown, that a cutting 65 feet deep, in the London clay, or other similar soil, may be made and its sides retained by efficient permanent constructions, at less cost per yard forward than the same cutting would require, with the slopes at which such soils can be trusted to stand—it will be admitted, that greater advantage would be obtained by the use of such constructions, where the depth is greater; especially where such treacherous soils occur as those through which the cuttings at New Cross and Forest Hill have been made.

It will not be exaggerating the case against sloped sides in clay cuttings, to assume that they cannot be trusted at less than 1½ to 1, even up to 20 feet in vertical height, nor beyond 40 feet at 2 to 1; nor will it be extravagant to state the slopes for a cutting 65 feet deep, at 2½ to 1. Many instances, besides those of the Croydon Railway cuttings, give conclusive evidence that the London clay and the superposed strata which occur in connexion with it, will not stand at less than 3 to 1 when the vertical height much exceeds 65 feet; whilst the uncertainty connected with 'silty clays' and 'soapy earths' exposed to the alternate action of air and water and heat and cold, renders even slopes of that degree of inclination a subject of constant anxiety and expense. If then, safe and (so to speak) imperishable constructions can be applied to retain the sides of a cutting in any soil that cannot be trusted at a less inclination than 2½ to 1, at less cost and in no greater time than the excavations with such slopes could be made—taking no account of subsequent cost for slips, or for the dry shafts and bushed drains, in some cases, or the gravel revetments and buttresses in others—there can be no question but that such constructions would be better than slopes.

It would be for every engineer to decide upon the substance required under the circumstances of any particular case; that assumed in the accompanying diagrams (plate I, figs. 3, 4, 5, and 6) is submitted, as, in the judgment of the author, sufficient in ordinary cases of clay cuttings, if executed with materials and workmanship of fair average quality, and such constructions may be applied in any such case where the depth exceeds 40 feet, and the slopes would require an inclination of more than 2 to 1, at less expense than that of forming slopes to the full depth. Of course, shoring, to retain the ground while the constructions are in progress, would form an important item in any such arrangement; but as the amount of earthwork in forming slopes, and the cost of contingencies connected with them when made, must increase at least as much as the difficulty of temporarily retaining the

Fig. 1.



Scale.-1 inch to 30 feet.

Fig. 2.

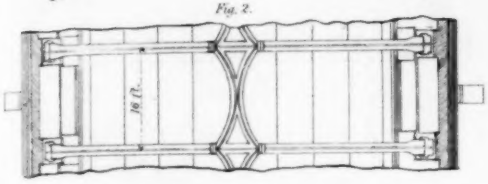
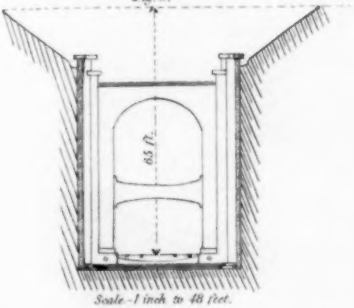
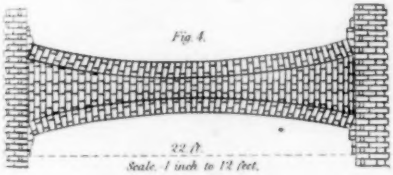


Fig. 3.



Scale.-1 inch to 48 feet.

Fig. 4.



Scale.-1 inch to 12 feet.

Fig. 5.

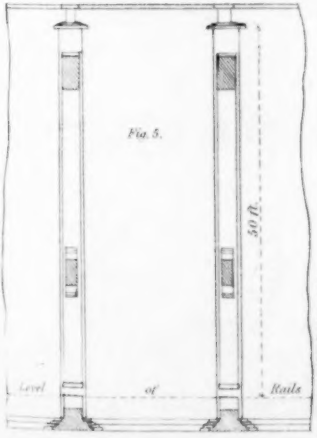
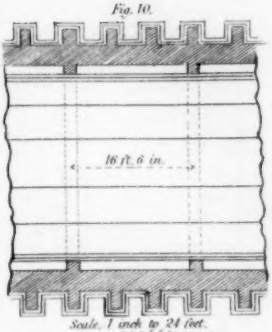


Fig. 10.



Scale. 1 inch to 24 feet.

Fig 12.

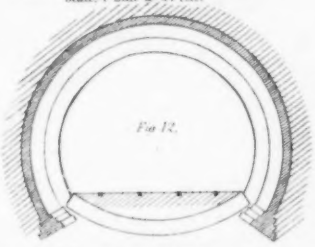


Fig. 6.

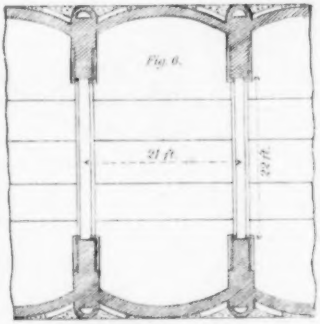


Fig. 14.

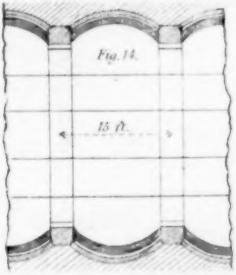
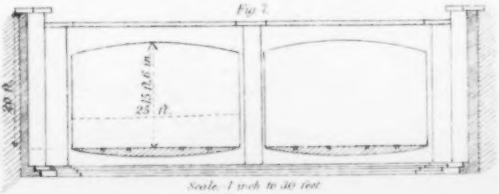


Fig. 7.



Scale. 1 inch to 30 feet

Fig. 8.

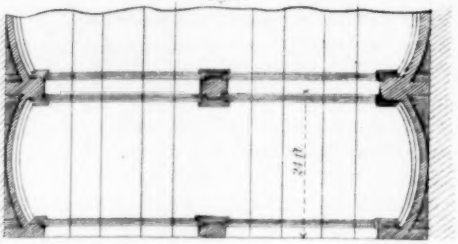
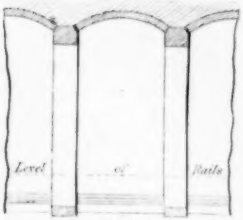
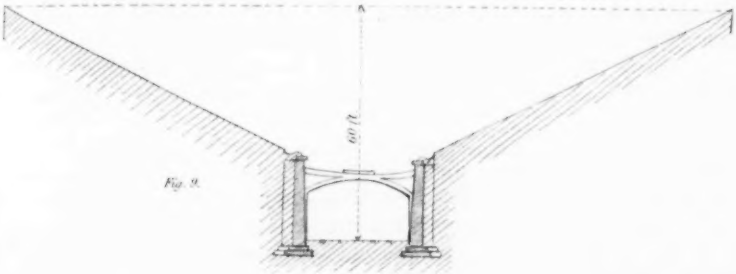


Fig. 13.



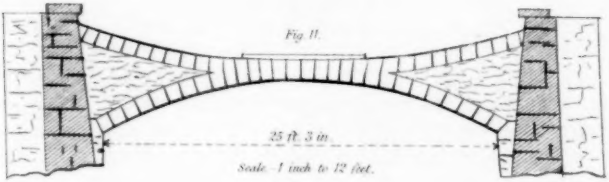
Scale. 1 inch to 24 feet.

Fig. 9.



Scale. 1 inch to 48 feet.

Fig. 11.



Scale. 1 inch to 12 feet.

Fig. 15.

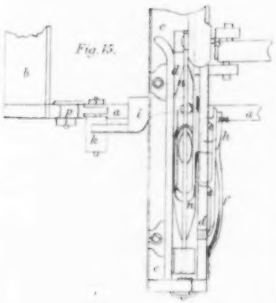


Fig. 16.

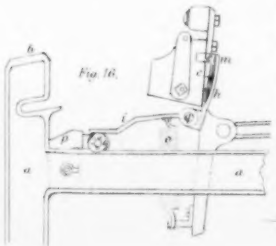
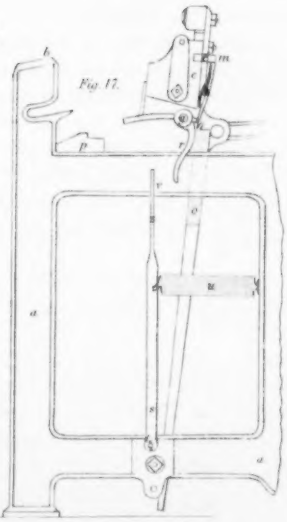


Fig. 17.



ground increases, the proposed arrangement would not be deprived of its presumed advantage, as it regards economy, on this account.

The diagrams (plate I, figs. 3 and 5) represent a cutting 65 feet deep to the level of the rails. It is assumed, that the ground at the top may stand for the first 15 feet at less than 2 to 1, and that it may, therefore, be cheaper to run out to that depth with slopes, leaving 50 feet from the rails, or about 52 feet in all, to be retained. As the bricklayer may follow up the excavator with bay after bay, his work lying mostly on the side and out of the way of the excavator, the latter would run out the spoil without interruption, his work being benched onwards and shored as he proceeded. As every compartment, with its buttresses, invert, abutting beams and counter-arches is complete in itself, the ground being backed against the counter-arches as the work rises, the shoring would come out and be sent on for use in the forward benches.

To relieve the work from water, a drain being run along over the middle of the inverts, or side-drains being passed by ring culverts through the buttresses, drain-shafts are carried up at the backs of the buttresses against the springings of the counter-arches, to within a few feet of the surface. These shafts being steined with open joints at intervals to admit drainage water and communicating with the drains below, would prevent the possibility of water lodging or accumulating about the backs of the counter-arches, or even in the ground itself.

The following estimates give the cost of forming 7 yards forward of an open clay cutting, 65 feet deep to the level of the rails, with slopes at 2½ to 1, and from a base 33 feet wide at 2 feet below the surface of the rails—and of the cost of constructions as above described and shown in the diagrams. Fair average prices are taken on each side; the earthwork in the heading, where the sides are to be retained, is taken at a higher price than that in the open cutting with slopes, with a further charge for the setting, striking and use of shoring. Contingencies are not charged upon either mode of operation, because they may not be pre-supposed greater in the one than in the other.

If the suggested constructions can thus be applied to cuttings with advantage, they may be held also to render embankments safer by diminishing their height; for the 32½ per cent. saved in the cutting may be applied to make it deeper, and so to diminish the adjacent embankment. Where an embankment would be made 50 feet high out of a cutting of similar depth, the latter may be made 65 feet deep and the former reduced thereby to 35 feet high, and for the same money at most.

In the comparatively shallow cutting between Camden Town and Euston Square, before referred to, a length of 24 feet forward of the retaining walls on both sides, as originally built, and where the height is 20 feet, contains very nearly 17 rods of brickwork; whereas permanently effective constructions of the kind above described (fig. 7 plate I, and 8 plate II,) with central piers in continuation of those which already exist for the bridges and galleries, would require, in the same length, less than 10½ rods, or about $\frac{3}{5}$ths of the former quantity.

WITH SLOPES.

	£	s.	d.
29·3 perches of land, at £160 per acre,	29	6	0
10,448½ cubic yards of earthwork, at 1s. 2d. per yard.	609	9	6
	£638	15	6

WITH CONSTRUCTIONS.

	£	s.	d.
7·64 perches of land, 160*l.* per acre,	7	13	0
753 cubic yds. of earthwork in open cutting above the top of constructions, at 1s. 2d. per yard,	43	18	6
1720 ditto ditto in heading, at 1s. 6d. per yard,	129	0	0
10 ditto clay punned at back of side walls, at 1s. 3d. per yard,		12	6
86 ditto strong gravel ditto, at 3s. 6d. per yard,	15	1	0
18 rods 184 feet superficial reduced stock brickwork, at 12*l.* per rod,	224	2	0
224½ feet extra to brickwork in cement, at 5*l.* per rod.	4	10	0
139½ feet ditto for picked bricks and in cement, at 7*l.* per rod,	3	12	0
311 feet ditto labor to skew-backs, at 1d. per foot,	1	6	0
16 yards ditto rendering in cement back of drain-shafts, at 2s. 6d. per yard,	2	0	0
77 ft. 7 in. cube stone in coping, including labor and setting, at 6s. per foot,	23	5	6
7 yards forward setting, striking, and use of shoring, at 3*l.* per yard,	21	0	0
Setting, striking, and use of moulds and centres,	5	0	0
	481	0	6
Difference, 32½ per cent., or nearly one-third, in favor of constructions,	157	15	0
	£638	15	6

Observations.—General Pasley stated, that the principle advocated by Professor Hosking, had already been put into practice by Mr. A. J. Adie, in the Chorley cutting, on the Bolton and Preston Railway. It is about 60 feet deep (plates I and II, figs. 9, 10, and 11) cut through sand, which though dry at the summit, became wet and silty near the level of the forming. In the sand there existed large masses of clay, which, after exposure to the weather, split from the top to the bottom. Fearing lest an ordinary wall might be forced forwards by this expansive action, and wishing to avoid the expense of a very thick wall, Mr. Adie introduced a series of arches or struts traversing the railway at intervals of 15 feet from centre to centre. These struts consisted of two arches of rubble and rough ashlar masonry, placed back to back (plate II, figs. 9 and 11.) The lower arch springing from the side walls, at a height of 11 ft. 4 in., and rising to 15 feet in the centre. The thickness of the arches in the centre, where they combined and were formed for some distance on either side by the same stones, was 12 inches, with a course of rough flag stones laid upon the strut to keep the joints dry. The retaining walls were 3 ft. 9 in. thick at the bottom, vertical behind, but battering on the face to 2 feet in thickness at the top. The back buttresses were parallel and projected 2 ft. 6 in. The walls were built upon a layer of engine cinders, which Mr. Adie preferred to concrete, and which he had found of great assistance in constructions in wet situations.

Captain Vetch said he was sure that Professor Hosking would be gratified to learn that his view had been already tested by a successful

experiment in a cutting near the village of Mosely, on the line of the Birmingham and Gloucester Railway. The average depth of the cutting was about 30 feet, with a firm gravel and dry sand at the top, which became wet below, and terminated in a quicksand at the level of the line of the railway. The cutting was accordingly made and the sides left rough, and at as great an inclination as the nature of the ground would admit of; when the period approached for opening the railway, no definite arrangement about a tunnel having been made, it was deemed provident to be prepared for such a work; Captain Vetch consequently proposed to Captain Moorsom, the engineer, and which met with his concurrence, that at every 15 feet, a rib, or inverted arch of brickwork (plates I and II, figs. 12, 13, and 14) should be thrown across under the railway, and then to carry up, on the ends of these inverts, projecting buttresses with a curved batter; each pair of buttresses, on the same side of the way, to be connected by a concave retaining wall, abutting against them and each opposite pair of buttresses connected by mutual support by a flying buttress, thrown across and over the railway. This construction afforded complete security to the slopes, and was executed at a moderate expense; it was, however, deemed prudent to conduct the concave side walls completely over the top and to make them abut on the flying buttresses, and so to form a complete tunnel at a very small expense; the buttresses, arches, and counter arches were all about 2¼ feet square, and the concave wall and roofing were only 9 inches thick, but were backed with a little concrete.

REFERENCES TO PLATES I AND II.

Fig. 1.—Transverse Section of the Euston Incline retaining walls, &c. (The dotted lines indicate the outline of one of the galleries.)
Fig. 2.—Plan.
Fig. 3.—Transverse Section through the centre of a bay.
Fig. 4.—Built abutting Beams.
Fig. 5.—Longitudinal Section.
Fig. 6.—Plan.
Fig. 7.—Application of the suggested constructions to a cutting similar to that for the Euston Incline.
Fig. 8.—Plan.
Fig. 9.—Transverse Section of the Chorley cutting with stone strutts.
Fig. 10.—Plan of the constructions of ditto ditto.
Fig. 11.—Stone strutts.
Fig. 12.—Mosely tunnel—Transverse Section.
Fig. 13.— Do. Longitudinal Section.
Fig. 14.—Plan.

London Civil Eng. & Arch. Journ.

Description of the Great Britain Iron Steam Ship, with Screw Propeller; with an Account of the Trial Voyages. By Thomas Richard Guppy, Esq., C. E.

(From the Proceedings of the Institution of Civil Engineers.)

Continued from page 11.

Mr. F. P. Smith repeated, that in his opinion, the screw was preferable to paddle-wheels under all circumstances; but it was in a rough sea, in combination with sails, that its merits were most apparent.

In going down the river with the *Archimedes*, he had repeatedly been passed by merchant steamers; but by the time he had reached Dungeness, the *Archimedes* had fetched up the loss, and was some distance ahead of the other steamers.

With a propeller of two arms, he had found, that if, instead of disengaging the screw and letting it run loose, the arms were fixed ver-

tically with the stern-post, the *Archimedes* would make, under sail, from 9 to 9½ knots per hour.

The propeller formerly used on board the *Rattler* was 10 feet in diameter, with two blades one-eighth part of the disk, and that now used was of the same diameter with the blades of two-sixths of a disk.

The speed was ascertained by the common and by Massey's patent log, carefully thrown, and attended to by the officers.

Mr. J. G. C. Curtis remarked, that it was necessary to be extremely cautious in using the results of the ordinary log; for although very useful for the common purposes of navigation, he did not think they ought to be allowed to enter into the computation of a vessel's velocity, where the 'slip of the screw' was to be determined.

Mr. Curtis, having been employed under Sir Edward Belcher, in his surveys in the Pacific, when the distance run by the vessel had to be determined with the greatest precision, might, perhaps, be permitted to make a few remarks on this subject.

The velocity of a ship being determined with the ordinary log, by ascertaining how much of the line, attached to the log, ran out in a given time, it was essential that both the time and the distance should be correctly measured; but that was seldom the case, as the sand in the sand-glass, which measured the time, was affected by every change in the atmosphere, and the line which measured the distance was alternately wet and dry, and being stretched unequally, at different parts, it was impossible that the marks, or knots, could remain at the distances which they were intended to indicate. These difficulties, when the vessel was going less than eight or nine miles an hour, might be partially surmounted, by counting the requisite number of beats of a good watch, instead of using the sand-glass, and by actually measuring the quantity of line which ran out, instead of counting the distance by the knots.

But in heaving the log at higher rates, it was difficult to prevent the log from being dragged after the ship by the friction of the reel; and whether the line was "taken off" or "paid out," there was always a degree of doubt whether the correct length had been allowed to go off the reel.

It was also nearly impossible to measure the time to the requisite degree of accuracy, by the 14 seconds sand-glass, which was generally used at high rates.

For instance, if a vessel were going 14 knots, the quantity of line representing one mile passed through the hand of the observer in one second of time; and hence, in order to obtain the speed to the eighth part of a mile, it would be necessary to measure the interval to the eighth part of a second. In like manner, to obtain a vessel's speed to the eighth part of a mile, when she was going 10 knots, it would be necessary to measure the interval to the sixth part of a second.

As these small portions of time could not possibly be measured by a sand-glass, persons unacquainted with the subject would not be surprised to learn, that Mr. Curtis had heard it expressed as an opinion, by most naval officers, and had found by his own practice, that the

rate of a ship going more than 10 knots could scarcely be obtained within a mile, under favorable circumstances.

As Mr. Curtis was convinced that the difficulty of accurately measuring the speed was one of the greatest causes of the discrepancies which existed in the accounts of the trials of vessels, he ventured to suggest an expedient "for determining a vessel's velocity at any given instant," which he thought would be more accurate than the common log. He proposed that the time which a vessel took in passing through her own length should be measured; from which her velocity per hour could be easily ascertained by proportion.

For this purpose he would fit, in convenient places, at a short distance from either end of a vessel, two rods, one vertical and the other horizontal, so that each pair, when seen in coincidence, should point in a line perpendicular to the direction of the vessel's keel. He would also have a buoy painted white and black, or any colors that would show well when in the water; to this he would attach a line considerably exceeding the length of the vessel.

This buoy should be passed forward, with plenty of spare line, to the bowsprit end, the end of the line being made fast abaft, ready to haul it in when done with.

When these preparations were complete, he would stand at the foremost pair of rods, with an assistant at the after pair; he would then direct the buoy to be hove overboard, as far out from the vessel as possible; as it passed his own rods, he would commence counting the beats of a good watch, until his assistant, by holding up his hand, or giving some other signal, indicated that it had passed the after rods; and then the calculation was easy. The number of beats counted was to the number of beats in an hour as the distance between the rods way to the velocity per hour.

In a vessel like the *Great Britain*, where the length was one-nineteenth of a nautical mile, the method proposed would possess great advantages over the common log, particularly at high velocities; and in practice the method would be very easy, as a table might be made of the velocity, corresponding to a given number of beats, and in smooth water, a good-sized chip, or a bottle, might be thrown overboard, and would save the trouble of hauling in the buoy.

Captain Hosken could not agree with Mr. Curtis as to the general incorrectness of observations by the log. He was convinced that with a correct glass, and a log properly "hove" by an experienced seaman, the distance would be given to one-eighth of a mile. Under all circumstances, he thought the common log was the best known means of ascertaining the speed at sea. "Massey's" log was, perhaps, the best of all the other instruments he had seen and tried. When a vessel was going less than 5 knots, it did not indicate sufficient distance; between 5 knots and 8 knots it was very correct; but above that speed, it again gave insufficient distance. He had "Massey's" log overboard from the *Great Western* all the way from New York to Bristol, when the distance shown was about 200 miles less than the ship had actually run. The average speed on that occasion was about 10 knots per hour. He, however, thought that Massey's

log was an excellent guide for running channel distances in the night, or in thick weather.

Sir John Rennie, President, directed attention to a remark made by Sir Charles Napier, as to the relative powers of vessels with screw propellers, and with paddle-wheels, for clawing off a lee shore.

Mr F. P. Smith was of opinion, that if a vessel with a screw used her canvas, as well as the propeller, she would claw off quite as well, if not better, than a paddle-wheel steamer, as, from the heeling of the vessel, the lee paddle would thereby lose much of its power.

Captain Hosken thought that a screw would make less lee-way than paddle-wheels, and would be quite as effective in clawing off. The American steamers had their paddle-wheels driven by separate engines, and had of course the advantage of being able to turn ahead on one side, and astern on the other. Even that, however, was not very effective; and of course was not applicable to a sea-going steamer, in which disconnected engines and wheels would be, practically, very dangerous.

Mr. F. Braithwaite said, that Captain Hosken's remarks on American steamers induced him to ask, whether there was any provision on board the *Great Britain* for disconnecting the engines from the screw, and in how short a time it could be done? Some very good methods of disconnecting had been designed and put in practice by Messrs. Maudslay and Field, and by Messrs. Seaward; and he understood that the system had been advantageously applied on board some French steamers. Two steamers recently on their passage from France to Algiers, with a fair wind, afforded a good example. One of them, being able to disconnect the paddles, and use the sails, saved half the fuel, and arrived within a few hours of the other that had steamed the whole distance. He believed that only about half a minute was occupied in disconnecting.

Mr. Guppy explained that, on board the *Great Britain* the means of disconnecting the screw was by taking out four screw-bolts, and drawing back a coupling-box, which occupied about a quarter of an hour, during which time the engines must be stopped. He considered it hazardous, with such powerful engines, to have any means of disconnecting which might be used while the machinery was in motion.

Mr. F. Braithwaite must contend that, under certain circumstances, it was very advantageous to have the power of disconnecting rapidly. The *Phœnix*, a vessel built by Messrs. Scott and Sinclair, (Greenock) struck, and sprung a serious leak; and when it was found that the hand-pumps could not gain upon the leak, the paddles were disconnected, and all the power of the engines being applied to pumping, she was kept afloat and was saved.

Mr. John Scott Russell corroborated the statement as to the *Phœnix*. The coupling alluded to was very efficient and safe.

With respect to the value of the lee paddle, he thought it of little use, even if the windward paddle could be disconnected. In some experiments on the subject, he found that a vessel using her power upon both wheels could be brought round in two minutes, and when using only one wheel, three minutes were occupied in bringing her

round; proving that the diminution of speed by the loss of one wheel was more than equal to the effect of the disconnected wheel. There were instances of vessels having one wheel disabled, and finishing their voyage with the remaining wheel, without much inconvenience in steering.

An instance was recorded of a steamer, commanded by a good seaman, though but little accustomed to steam navigation, getting his vessel into the trough of the sea, in very heavy weather, and being entirely unable to bring her head to windward, until the mate suggested reversing the engines; by which means she was easily brought up, and afterwards made her passage safely.

Captain Hosken stated, in reply to a question from the President, that he thought the *Great Britain* would not be more liable than other ships to "broach to" when scudding. His opinion was founded upon experience in the *Great Western*. The same question had been put to him by old seamen, before the first voyage of that vessel, when, from that ship's great length, it was thought there would be more than usual difficulty in steering her: Captain Hosken differed from the general opinion; and time had clearly show that he was right, as she scudded and steered as well as any, and better than most other ships. The *Great Western* was as great an increase in size when she was built as the *Great Britain* is now; and he felt confident that ship would prove as triumphant a specimen of naval architecture.

Scudding well was a point of great importance, and was entirely a seaman's question. No point required more judicious management and correct judgment than as to when a ship could not scud longer with safety, and ought to be "hove to."

He had very often, in the *Great Western*, been scudding past very fine ships of from 500 tons to 1000 tons, not very deep in the water, "laying to," because they could not scud with safety.

There were now several steamers longer than the *Great Western*, and he had never heard that any difficulty had been experienced with them on this important point.

So far as he had the opportunity of trying, he would say most decidedly the *Great Britain* steered easier and better than the *Great Western;* and he was sure he could not find a better ship to compare with, either in the naval or mercantile service.

Mr. Pim mentioned an advantageous application of the combined power of the screw and sails, which had been practiced by his relations, Messrs. Pim, of Hull. They had adapted to two fine trading schooners screw propellers, driven by small engine power. The result of this experiment had proved that, in cases where extreme speed was not an object, but in which regularity was essential, this plan might be advantageously adopted; especially for commercial purposes, in which it was requisite to combine economy and a certain amount of dispatch.

The vessels he alluded to were very sea-worthy boats; and on one occasion, when on a voyage to Dublin, the *Shannon*, a large merchant steamer, had been obliged to run for shelter, one of these vessels had ridden out the gale, and made her passage. He believed that they

were propelled by Mr. Smith's screw, and that he could give all the particulars of their construction.

Mr F. P. Smith said the vessels alluded to were the *Margaret* and the *Senator*, trading from Hull. They were fine four-masted schooners, of 242 tons burthen; each vessel had on board two engines, severally of 14 horse power, placed as close as possible to the screw propeller, which was driven by gearing. The total weight of the engines, screw, and tubular boilers with their water, was 15 tons, and they worked under a pressure of 8 lbs. to 10 lbs of steam.

In a trial between one of these vessels and the *Shannon* steamer, it was found that, between Dublin and London, the *Shannon* consumed 90 tons of fuel, while the schooner, with 300 tons of cargo on board, only used 18 tons of coal, and arrived in London within 10 hours after the *Shannon*. In an experiment with the *Senator*, with 172 tons of cargo on board, when steaming only, the rate through the water by the log was 6½ knots; and with sails and steam the rate was 9½ knots to 10 knots. It was remarkable that this increase of speed did not appear to augment the consumption of fuel; whereas, with paddle-wheels and sails the consumption of fuel increased in proportion to the rate of the vessel through the water.

Captain Hosken could not permit the discussion to terminate without stating that in his opinion, as a naval officer, one of the great merits of the screw as a propeller, was its capability of being adapted to a full-rigged ship, using at times her canvas as usual. The British seamen would thus be fully as much employed as heretofore, and they would retain that superiority which had so largely contributed to the high position held by Great Britain in the scale of nations.

To be Continued.

Eleventh Report of the Engineer of the Central Railroad and Banking Company of Georgia.

To R. R. Cuyler, Esq., President:

Sir:—The period has arrived when it becomes my duty to present you with a Report of the operations of the road for the year ending 30th ult., and its condition at that period. The subjoined table exhibits the earnings of the road for the year.

It will be perceived from the table, that the earnings exceed those of the previous year by $40,026·74.

The total number of bales of cotton transported during the year is 114,641, against 77,437 the previous year.

The shortness of the cotton crop in that part of the State which is tributary to our road, has had the effect of diminishing the receipts of the last quarter of the year. If we had transported the same amount of cotton during that period, as we did during the corresponding period of the previous year, the earnings of the road would have been increased about $30,000—and amounted to nearly, or quite $400,000.

Earnings of the Road for the Year ending November 30th, 1845.

Year.	Months.	Number of Passen'rs	Passage Money.	Freight and U. S. Mail.*	Total Earnings.	Total for the same period the previous year.
1844	Dec'r.	1,206	4,576·28	$30,310·46	$34,886 74	$31,253·63
1845	Jan.	1,345	4,755·05	26,660·16	31,415·21	29,758·47
"	Feb'y.	1,041	4,649·75	32,137·65	36,787·40	25,704·62
"	March	1,138	5,351·13	33,897·46	39,248·59	25,867·86
"	April	1,179	4,891·50	27,795·44	32,686·94	17,676·87
"	May	1,402	5,673·00	27,639·23	33,312·23	20,092·59
"	June	1,144	4,379·00	9,523·49	13,902·49	10,808·04
"	July	1,153	4,707·98	18,821·10	23,529·08	12,103·64
"	Aug'st	787	3,953·86	12,985·37	16,939·23	18,181·36
"	Sept'r	1,132	4,770·95	25,409·58	30,180·53	35,410·90
"	Oct.	1,624	6,820.87	35,219·14	42,040·01	50,962·72
"	Nov.	1,460	5,580·74	27,941·56	33,522·30	50,603·31
	Totals,	14,611	60,110·11	$308,340·64	$368,450·75	$328,424·01

*The receipt from the U. S. Mail is $1715 per month, or $20,580 per annum.

We had made provision in motive power, cars, and outfit generally, for a full business both ways, and as our upward freight has been equal to that of the last year, we have been obliged to run trains of empty cars, on our down trips, for a great portion of the last quarter of the year. The number of passengers has decreased during the year compared with the previous year; this may be accounted for by the circumstance of our having had, during the previous year, several thousands who attended religious, political, and military meetings, while we have had none during the last. Our night trains have had the effect also of diminishing the number, though there is a greater proportion of through passengers, and the receipts have been increased from that source.

We have been remarkably successful in our night running; no accident of any importance to the trains has occurred; and their regularity has been fully equal to that of the day trains. The expenses have been somewhat increased, as we require three trains instead of two to be constantly in service, with an additional conductor and engine crew.

The road, throughout its whole extent, is in as good order as at any previous period; and the trains have, during the whole of the past year, performed their trips with great regularity and freedom from accident.

The whole distance performed during the year by all the engines is 223,241 miles. We are entirely relieved from the difficulties arising from the breaking of axles—an accident of the kind now very rarely occurs.

The expenses of maintaining and working the road during the year, have been as follows:

Maintenance of Way.—Including timber, spikes and all other materials, labor, salaries of superintendent and assistant, with all other

expenses of repairs of road, bridges, wells, cisterns, turn-outs, turn-tables, &c., $78,286·58

Maintenance of Machinery and Motive Power.—Including all work and materials for repairs of engines, machinery in shops, wages of runners and firemen, oil and tallow for engines, fuel and water for do., salaries of superintendent and master machinist, &c., 54,460·49

Maintenance of Cars.—Including materials and labor upon cars, oil and tallow for do., salary of superintendent and master carpenter, 8,573·00

Transportation Expenses.—Including train hands, labor at depots, clerks, agents at way stations, labor at do., salary of superintendent, insurance on cotton and damage, 42,505·25

Incidental Expenses.—Including printing, stationary, and miscellaneous expenses, not embraced under other heads, 3,061·07

Total $186,886·39

We have done, in addition to the ordinary repairs of track, a large amount of work on the bridges and culverts, during the past year, and have renewed the spikes on several miles of the lower end of the road, on which the original spikes were too light.

The several additional works mentioned in my last report, as being necessary to render the road complete, have been nearly accomplished. We have erected during the past year, a new and commodious car-shop, a convenient passenger house and offices at the Savannah depot—built an additional cotton yard, with the necessary tracks, turn-outs and tables, at the Macon depot—added four of Baldwin's improved engines to our motive power, besides rebuilding the "Georgia" in our own shop; making our number now twenty, all of which are in working order except the "Macon," which is dismantled. We have also embanked about one mile of the road which was built on trestle work, and intend to continue the operation on a moderate scale during the current year.

The engine house at the centre of the road is nearly completed—when finished, it will contribute much to the facility and economy of working the road; a house to shelter the passenger cars at the Savannah depot has also been commenced; this is very necessary to protect the spare cars from the weather while not in use. Our present number of burthen cars is 180; we have on hand, and in a state of forwardness, the wheels, axles, springs and other materials, to increase the number to 200, which, it is thought, will be sufficient for any press of business that may be expected for some time to come.

A reduction of the regular force for keeping the track in order, will be made for the approaching year, but a considerable number of hands will be required during the year on the bridges.

A reduction of expenses will be made in the machinery and motive power department, and in the car department.

Our operations have suffered less during the past autumn months by sickness than heretofore, and I doubt not that the whole line of road is improving in healthiness.

During the past year, I have made an experiment of substituting iron cross ties for our present wooden sleepers. In renewing the sleepers as they decay we use no other timber than cypress—this is not to be obtained near the road above the Ogechee river, and we are obliged to transport the sleepers from the lower portions of the road, which increases the labor and expense.

I have long entertained the opinion that a much smoother track could be attained by removing entirely the sleepers, which support the string pieces at intervals, so as to give the string piece a continuous and uninterrupted bed of earth. I am now convinced of the correctness of this opinion. The plan is as follows:

The string pieces (6 by 12 inches,) are laid on an even, well rammed surface, and in length of from 30 to 60 feet—at the joinings, a bolster piece of the same scantling as the string piece and three feet long, is placed lengthwise immediately under the joint, and the string piece pinned to it. The iron rails, of the ordinary ⊥ pattern, are laid along the centre of the string piece, and the track is kept in gauge by the iron tie, a piece of flat bar iron, half an inch thick by two inches wide; this tie is let flatwise into the string piece flush with its upper surface under the rail, and the ends, bent into the form of a hook, grasp the outside of the bottom web of the rail at the joint. The rail is confined in other respects as usual with the ordinary hook spikes. The track is filled even with the top surface of the string pieces. We have laid about seven hundred feet in the manner above described, on a portion of the road where the earth was springy, and it was difficult to keep the track in adjustment. It has borne the transit of the trains for several months past, and keeps in much better order than with the wooden sleepers. The following statement shows the comparative expense of a mile of road with iron cross ties, as above described, and with wooden sleepers for twenty years:

With Iron Cross Ties for one mile.

352 iron bars, 18 lbs. each, at 4 cents per lb.,	$ 253·44
Bending the ends and preparing them, at 4 cents each,	14·08
330 bolster pieces under the joinings of string pieces (6 by 12 inches, and 3 feet long) at $7 per thousand feet, B. M., to be renewed three times in 20 years,	166·32
Putting in 352 ties, - - -	57·12
Amount, - -	$ 490·96

With Wooden Sleepers for one mile.

660 cypress sleepers, allowing them to be left sound at the end of 20 years, will have to be renewed three times; then 1980 ties at 25 cents each, - - -	$ 495·00
Putting in 1980 ties, - - -	471·24
Amount, -	$ 966·24

Difference in favor of iron cross ties in a period of twenty years, per mile, - - -	$ 475-28
The first cost for substituting the iron for the wood is, per mile, - - - - -	379-00
First cost of renewing the wooden sleepers,	322-00
Difference, -	$57-00

You will thus perceive that in a period of twenty years, a saving of four hundred and seventy-five dollars would be effected, while the additional first cost is only fifty-seven dollars per mile. The cost of putting in the ties, both of iron and wood, is estimated from actual experiment.

I have said nothing in the above estimate, of the saving which would be made in the labor of keeping the track in adjustment; this would not be less than $10 per mile per annum, and would swell the difference in favor of the iron ties to nearly $700 per mile in the period of twenty years.

I think the subject worthy of the attention of the Board of Directors. In the arrangement of the details of the plan, in making this experiment, I am happy to acknowledge my indebtedness to the judgment and ingenuity of Mr. William M. Wadley, one of our contractors for repairs.

I am, sir, very respectfully, your ob't. serv't.

L. O. REYNOLDS, Chief Engineer.

Engineer's Office, Central Railroad, Savannah, Dec. 3, 1845.

Report of the Board of Managers to the Stockholders of the Mine Hill and Schuylkill Haven Railroad Company, at their Annual Meeting, held January 12th, 1846.

The Board of Managers of the Mine Hill and Schuylkill Haven Railroad Company, respectfully submit the following as their Annual Report to the Stockholders.

Of the coal transported during the past year from within the limits of Schuylkill county, a large portion was from the mines contiguous to the Company's road.

By the returns of the Collector, it appears that the net tonnage transported amounts to four hundred and ten thousand five hundred and ninety-two 10-20 tons; of which amount one hundred and sixty thousand nine hundred and ninety-seven 16-20 tons were from the Main, or West Branch; seventy-seven thousand six hundred and fifty 11-20 tons from the West-West Branch; one hundred and fifty-one thousand four hundred and twenty-three 3-20 tons from the Wolf Creek Lateral, tributary to the Main or West Branch; and twenty thousand five hundred and twenty-one tons from the Muddy Branch and its extension, tributary to the West-West Branch.

There was also a net miscellaneous tonnage which passed the scales

of the Company equal to two thousand five hundred and eighty-nine 18-20 tons.

The tolls received amount to seventy-five thousand one hundred and thirty-three dollars thirty-eight cents.

For general repairs and maintenance of the road, the sum of four thousand and sixteen dollars fifty cents has been expended.

For the expenses of the Board, thirteen hundred and ninety-seven dollars fifty-eight cents were appropriated, and on account of interest, twenty-two hundred and eighty-three dollars thirty-three cents were disbursed.

In explanation of the greater expenditure incurred during the past year for general repairs and maintenance of the road, it must be stated, that damages by freshet were sustained, in amount about four hundred dollars; and that the removal of snow for the accommodation of the operators was attended by a cost of one thousand and fifty-seven dollars 15 cents.

On account of permanent improvements, the sum of nine thousand nine hundred and eighty-three dollars 81 cents were expended.

These improvements were made on a portion of the light, or ascending track of the main road, on the Wolf Creek Lateral, and the Muddy Branch and its extension. The cost of drainage at different points was six hundred and fifty dollars 44 cents.

Two dividends have been declared on the capital stock of the Company, equal to fifteen per cent. on the number of shares issued at the time of their declaration. The tax on the last of these dividends, amounting to fifteen hundred and ninety-five dollars sixty-four cents, has been paid into the State Treasury.

The sums heretofore paid annually to the Commonwealth, since the act of assembly took effect, are as follows: 1841—$1,700·28; 1842-$1,988·07; 1843—$2,121·45; 1844—$2,329·12; 1845—$2,470·52.

Of the loans obtained by the Company, the only existing incumbrance is a mortgage formerly held by the Bank of the United States, and which, since the last annual meeting, has been further reduced by the payment of ten thousand dollars, leaving a balance due of twenty-five thousand dollars—one-half of its original amount.

The shares of capital stock amount to eight thousand—equal to the sum of four hundred thousand dollars, and exhibiting an increase on the amount reported at the last meeting of the Stockholders, as then issued, of seventeen hundred and eighty-nine shares.

The issue of these shares was consequent upon the subscriptions requisite for the payment of iron in the course of importation, and also for the extension of the road to the Swatara coal district.

This district, according to a report made to the legislature, contains an area of one hundred and twenty acres of coal land.

In rendering thus tributary to the Company's road a field so extensive, it is believed that to the coal trade generally, the connexion will prove beneficial by an increased transportation through the great channels of communication with the Schuylkill region. The distance from Tremont, at the head waters of the Swatara, to the proposed point of connexion on the West-West Branch, is estimated to be seven

miles and a quarter. The grading of the work is begun, and with every probability of completion about the first of June next. Of the superstructure it may be remarked, that it is intended to be of the same kind as that now in use on the best portions of the road.

For the supply of iron rails no contracts as yet have been made. The state of the foreign market being so changed since the last orders of the Board were given, action on this subject is necessarily deferred.

The attention of the managers, moreover, has been drawn to the specimens of railroad iron recently produced by American skill, and which are so creditable to native enterprise as to present strong inducements for the preference of a home market in procuring the supply of this material. Should it therefore be in the power of the managers to avail themselves of such source, the circumstance will be reported with much gratification at a future meeting of the stockholders.

It is known to the stockholders, that in the re-construction of the Company's road, the chief object was to provide a superstructure of substantial character, capable of sustaining the heavy and increasing transportation of the district, and, as a consequence, to exclude those large disbursements for annual repairs, which had been incidental to the original work.

The accomplishment of the object chiefly in view having been attended with the consequence anticipated, it may be interesting to state, that for three successive years, the aggregate amount expended for repairs, does not equal, by the sum of six hundred dollars, the disbursements on such account during the year 1841.

But it is also known to the stockholders, that no superstructure, however substantial its kind, can be regarded as *permanent*, except in the relative sense of the term. The effects of time, or use, and of climate, however imperceptible at first, are nevertheless certain, and ultimately visible in a deterioration which is beyond repair.

It is the part of wisdom, therefore, to prepare for such results; and believing that there existed among the stockholders coincidence of opinion on this subject, the Board recently adopted a resolution, authorizing the reservation annually, of a sum to be appropriated to the foundation and increase of a fund to be entitled "The Depreciation Fund of the Mine Hill and Schuylkill Haven Railroad Company:" the renewal of the Company's works, as occasion may in future require, being exclusively the object of said fund.

In regard to the deterioration of railroads, the managers are aware that very different conclusions are formed by those who advocate either of the two principal modes of transportation now used for inland communication, or trade. But in reference to their action on the subject of the resolution adopted, the Board anticipate no serious difficulty. The experience of foreign corporations furnishes, with the authority of precedent, a standard also of estimates which, with other sources of consultation, will serve to direct the managers in their final judgment on so important a question.

Should, therefore, the resolution of the Board be carried into effect, the perpetuation of the Company's works for great public interests,

may be regarded as beyond doubt; whilst an opposite course must result in an annihilation of capital, which at present gives efficiency to the operations of the miner, and value to the possessions of the landholder.

Since the transportation was commenced, the *net* miscellaneous tonnage which has passed the scales of the Company, amounts to *two millions four hundred and twenty-seven thousand seven hundred and ninety-one tons.* To this amount must be added the tonnage which has passed during the same period, *toll-free*, under an allowance to the operators, originally of five, and subsequently of seven and a half per cent., viz., *one hundred and seventy-six thousand tons.* The enterprize thus shown, in a branch of trade so important to the community, is certainly entitled to the highest commendation, but cannot be dissociated from the interests of those whose capital has constructed the avenues to a market.

In reviewing the past, it is due to the stockholders to state, that for a series of years, there was expended for permanent improvements, and exclusively of the disbursements for general repairs and expenses of the Board, a sum almost equal to one-half of the tolls received during the same period; whilst the loans obtained by the Company were necessarily at the same time subjects of consideration in the employment of means for their reduction, or gradual repayment.

Experience has therefore demonstrated, that so long as a just sense of this reciprocity exists among the operators, the resources of the district embraced by the Company's works, will continue to receive a development at the hands of the stockholders, commensurate at all times with their ability.

On behalf of the Board of Managers,

JAMES DUNDAS, President.

Philadelphia, January 12th, 1846.

Report of the President and Managers of the Philadelphia and Reading Railroad Company to the Stockholders, Jan. 12, 1846.

The managers have much pleasure in communicating to you the present position of the Company, the business of the past year, and the arrangements which are made for the future.

Annexed is a statement from the Treasurer, showing the liabilities on the 30th November last.

It will be observed that at that time the Company was encumbered with a large floating debt. The managers have since made a negotiation with the Share and Bond-holders on the following terms, viz.:

For an issue of Stock at par,			$1,100,000
" Mortgage Bonds, payable	1860,	do.,	250,000
" Obligations,	"	January 1, 1848,	75,000
" Do.	"	" 1, 1849,	75,000

making in all, one million five hundred thousand dollars.

For the obligations, payable in 1848 and 1849, the money will be

immediately paid, and the residue, one-fifth in cash and the balance in four quarterly instalments.

The first payment of 270,000 has been placed in the hands of the President and Treasurer, (in money, and in the obligations of the Company now due,) to await your approbation of the arrangement, and your authority for the issue of the shares and bonds.

By reference to the statements of the Treasurer, it will be seen that on the 30th November last, the entire debt was - - -		$8,318,530·91
From which deduct		
Cash and cash assets, -	62,178·98	
Bonded debt, - -	6,637,200·00	
Permanent mortgages, -	124,500·00	
		6,823,878·98
Leaving of floating liabilities, -		$1,494,651·93

which are provided for by the negotiation just completed.

The managers feel that it must be a matter of great satisfaction to the proprietors, to know that the business of the past year, and the very flattering prospects for the future, have enabled them to complete so favorable an arrangement.

A statement is subjoined, showing the net revenue for the fiscal year, to be - - - $507,304·99

If the Company had been then free from a floating debt, the result would be thus: viz.:

Interest on old bonded debt,	$6,637,200 =	388,824·00
Do " new do.	400,000 =	24,000·00
		$412,824·00
Leaving for the holders of Stock with the proposed new issue amounting in all to $3,120,000. -		$94,480·99

which would be upwards of three per cent.

The want of a larger number of engines and coal cars has again limited the revenue, although those in use have been quite equal in efficiency to the most sanguine estimates made at the beginning of the year.

The rapidly increasing business in coal has induced the managers to assume the responsibility of contracting for 1000 new iron coal cars, and 17 locomotive engines of the first class, to be delivered prior to 1st June next.

Taking past experience as a basis, the machinery now employed in the coal trade and that contracted for, will be fully adequate to the transportation of 1,250,000 tons of coal during the present year.

The Company have already received applications from parties engaged in that trade for the conveyance of a quantity far beyond the amount specified.

As the parties making these proposals may fall short of the business they now expect, the managers submit to you the propriety of authori-

zing them to contract for 500 more coal cars with a corresponding increase of locomotive power. They believe that, unless the prosperity of the country is checked by unforeseen circumstances, there will be full employment for all the proposed machinery by the 1st of July next, at which time it could be placed on the road.

For your information, and to enable you to arrive at a proper conclusion on this question, a table taken from the Miner's Journal of the 10th inst. is affixed, showing the quantity of anthracite coal sent to market from the different regions in Pennsylvania, from the commencement of the trade in 1820 to 1845, inclusive.

It will be perceived that the quantity exported from the Schuylkill region increases in a much larger ratio than from any other, having more than doubled during the last four years. It will also be noticed that the increase in the business of this Company is altogether unprecedented.

It may be satisfactory to the proprietors to have the views of the managers relating to the business of the current year, based upon the capabilities of the machinery now on the road, and that contracted for and in course of delivery, as well as the revenue resulting from it. It would be as follows, viz.:

Gross Receipts.

From passengers, merchandize, mail, rent of wharves at Richmond, &c., - - - -	$225,000
For transportation of coal, 1,250,000 tons, say at $1·20,	1,500,000
	$1,725,000

	Tons.		Tons.		Tons.
Say, in January,	50,000	May,	110,000	Sept.	140,000
February,	40,000	June,	130,000	Oct.	140,000
March,	70,000	July,	150,000	Nov.	120,000
April,	90,000	Aug.	150,000	Dec.	60,000

The expenses as estimated by the Superintendent of Transportation and Engineer, are as follows, viz:

For the transportation of	
1,250,000 tons of coal at 33 cents,	$412,500
32,500 " merchandize at 75 "	24,375
38,000 passengers, at 41 "	15,580
Expenses of transportation of coal, passengers, and merchandize over the State Railroad, for the year, -	32,800
Superintendence and salaries, - - -	17,000
Office expenses, stationary, &c., - - -	4,450
Wages of Watchmen at depots and switches,	4,200
Work at depots, &c., - - - -	1,600
Sundries, and all other expenses, - - -	2,475
Expenses of transportation department, - -	$ 514,980

Brought forward,		$514,980
Repairs of roadway,	$112,000	
Watchmen on bridges,	10,000	
		122,000
To which add		
Dumpage,		70,000
Contingent expenses of office in Philadelphia,		30,000
Total expenses,		$736,980
Leaving a balance of		$988,020

The managers state that they can at once contract for the transportation of the quantity of coal stated in the foregoing estimate.

They submit that their past experience warrants them in asserting a most confident opinion that the expenses, with such a traffic, will not exceed the estimate.

That experience is confirmed by English Railway Companies, which have been doing a large coal traffic for many years. At the head of these stands the Stockton and Darlington. On a late occasion, before a committee of the British Parliament, Joseph Pease, Esq., chairman of that Company, stated, with reference to the transportation of coal on the proposed London and York Railroad, that one farthing per ton per mile, would be found ample to cover all transportation expenses, including five per cent. per annum interest on the capital employed in the movable stock and the proportion of maintenance of way belonging to this branch of the traffic.

At this rate, the expense of conveying coal from Pottsville to Richmond would be about 47 cents per ton, or deducting interest on cars and engines 40 cents per ton, including maintenance of way, or about 30 cents for mere transportation.

This is rather less than our experience hitherto, though if the road was exclusively stocked with the large cars and engines, the expenses would be diminished within this estimate.

Some of the elements of expense may be greater and some less than here, but if on the whole this is somewhat in favor of the English lines, it must be observed that our gradients are infinitely more favorable than those on the proposed London and York railway, to which this evidence refers.

The great knowledge of Mr. Pease upon this subject must be regarded as the reason for this reference to his views. The managers respect his opinion as the highest authority which can be quoted on this question.

The statements of the superintendent of transportation, and engineer are appended.

It will be observed that the revenue from the transportation of coal, (the chief business of the Company,) is nearly double that of the previous year, the cost of transporting it reduced from $41\frac{8}{10}$ to $37\frac{1}{10}$ cents per ton, and that a still further reduction may be expected.

The accompanying documents are full and explanatory, and therefore require but little comment.

By reference to the general account of the Treasurer, it will be seen that the liabilities of the Company—

On the 30th November last, were	-	$10,338,530·91
Deduct cash, - -	$5,059·02	
Balance due transportation account for freight bills due, &c., &c.,	57,119·96	62,178·98
		$10,276,351·93
The same on Nov. 30, 1844,		9,398,354·96
Increase, -		$877,996·97

The expenditures have been as follows, viz:

Construction, (see Engineer's report,)	$346,965·45		
do. for claims adjusted and settled since last report,	24,491·08		
		$371,456·53	
Railroad iron, . .		11,333·50	
Land damages, .		32,923·70	
Engines and cars, . .		312,186·78	
Real estate, . .		23,173·07	
Depots and workshops, including new engines, machinery, stationary, &c.,		59,516·18	
Commissions and charges, .		40,190·38	
Materials on hand, .		23,826·59	
Interest, including arrears on claims unsettled at last report, .		510,696·23	
		$1,385,301·96	
Deduct net receipts, . .		507,304·99	
			$877,996.97

In conclusion, the managers congratulate the stockholders on the prosperous position of the Company.

By order of the managers,

(Signed) JOHN TUCKER, *President.*

Office of the Philadelphia and Reading Railroad Company, Philadelphia, January 10th, 1846.

The following statements are extracted from the Report of G. A. Nichols, Esq., Superintendent of the Transportation Department.

STATEMENT E.—*Table of Number, Names, Makers, and present condition of all Locomotive Engines owned by the Philadelphia and Reading Railroad Company.* November 30, 1845.

Name of Engine.	Total Weight in Tons.	Name of Maker.	When put on Road.	Total number of miles ran to date.	Present Condition.
United States	18·6	Baldwin & Co., Philadelphia.	July '44	32,564	On duty, in Coal Trade.
New England	19·7	do.	July '44	32,188	do. do.
New York	19·1	do.	Aug. '44	33,066	do. do.
Ontario	19·1	do.	Aug. '44	29,487	do. do.
Virginia	19·1	do.	Sept. '44	29,286	do. do.
Hudson	19·5	do.	Oct. '44	20,422	do. do.
Niagara	19·6	do.	April '45	18,078	do. do.
Pacific	19·5	do.	April '45	15,535	do. do.
Independence	19·5	do.	May '45.	16,624	do. do.
Oregon	19·5	do.	May '45	14,815	do. do.
St. Lawrence	19·5	do.	June '45	12,256	do. do.
Constitution	19·5	do.	June '45	12,579	do. do.
Champlain	20·1	do.	Sept. '45	5,162	In shops, under repairs.
Neversink	10·6	do.	May '38	71,010	Rebuilding in Reading Work Shops to an Engine of 90 per cent. more power.
Seminole	13·1	do.	Feb. '40	69,008	On duty, Richmond Wharves.
Perkiomen	12·6	do.	April '42	54,015	do. do.
Mahanoy	12·6	do.	May '42	47,014	On duty, in Coal Trade.
Wyoming	10·8	do.	May '42	61,987	On duty. Const. and Roadway Dep.
Saratoga	12·0	do.	June '42	46,715	Rebuilding in Reading Work Shops to an Engine of 90 per cent. more power.
19 in all.		Made by Baldwin & Co.			
Atlantic	18·7	Norris, Philadelphia.	Aug. '44	15,999	On duty, in Coal Trade.
Philadelphia	18·0	do.	Oct. '44	23,935	In order, ready for use.
Manatawny	13·8	do.	Oct. '42	63,988	On duty, in Coal Trade.
America	13·4	do.	Oct. '42	53,778	In order, ready for use.
4 in all.		Made by Norris.			
Columbus	17·4	New Castle Manufacturing Co.	April '44	22,854	On duty, Falls Grade.
Monocacy	13·7	do.	Mar. '42	59,363	do. in Coal Trade.
Pottsville	11·0	do.	Sept. '42	49,992	do do.
Tuscarora	11·8	do.	Nov. '42	45,111	do. Lateral Roads.
Pennsylvania	11·4	do.	April '43	42,434	In shops, under repair.

Pottsville	11'0	do.	Sept. '42	49,992	do.	do.
Tuscarora	11'8	do.	Nov. '42	45,111	do.	Lateral Roads.
Pennsylvania	11'4	do.	April '43	42,434	In shops, under repair.	
Ontalaunee	12'0	do.	July '43	37,941	On duty, Coal Trade.	
6 in all.	. .	Made by New Castle Manufg Co.				
Gowan & Marx	11'0	Eastwick & Harrison, Philada.	Jan. '40	58,691	On duty, City Coal Trade.	
Boston	12'1	do.	Sept. '42	61,085	do.	Freight Train.
J. E. Thayer	12'5	do.	Oct. '42	64,627	do.	do.
3 in all.	. .	Made by Eastwick & Harrison.				
Conestoga	11'8	Locks & Canals Co., Lowell.	May '43	38,749	On duty, Coal Trade.	
Tioga	11'8	do.	July '43	32,210	do.	Lateral Roads.
Schuylkill	11'8	do.	July '43	32,316	do.	Coal Trade.
Shamokin	11'8	do.	July '43	39,137	do.	do.
Shenandoah	11'8	do.	July '43	29,283	do.	do.
Huron	11'8	do.	Aug. '43	39,957	do.	Lateral Roads.
Osceola	11'8	do.	Aug. '43	30,377	do.	do.
Potomac	11'8	do.	Aug '43	43,850	do.	Coal Trade.
Erie	11'8	do.	Aug. '43	38,128	do.	do.
Roanoke	11'8	do.	Sept. '43	29,338	do.	do.
Cherokee	13'9	do.	Sept '43	25,631	In order, ready for use.	
11 in all.	. .	Made by Locks & Canals Co.				
Lycoming	10'4	Dotterer & Co., Reading.	Aug. '42	37,969	In shop, under repair.	
Delaware	10'1	Ross Winans, Baltimore.	May '38	1,586	Not used at present.	
Rocket	8'4	Braithwaite & Co., London.	May '38	80,072	On duty, Const. and Roadway Dep.	
Engineer	8'8	do.	May '38	61,462	In shop, under repair.	
Spitfire	8'4	do.	June '38	70,672	On duty, Wood Train.	
Planet	8'4	do.	Aug. '38	71,810	In good order, ready for use.	
Hecla	8'4	do.	July '40	90,792	On duty, Extra Work on Line.	
Gem	8'4	do.	Mar. '41	89,721	Rebuilding to an efficient Pass. Engine by Company.	
6 in all.	. .	Made by Braithwaite & Co.				
Reading	16'2	Rebuilt by Reading Railroad Co.	Oct. '42	24,846	Of 50 per cent. more power; cost $1891; in shop under repair.	
Antelope	9'3	do.	June '38	66,356	Altered to a good Pass. Engine, cost $1938. (both on duty, Pass. Trains.)	
Atalanta	10'3	do.	April '41	62,841	Altered to a good Passenger Engine, cost $2134.	
3 in all	. .	Rebuilt by Reading Railroad Co.				

54 Locomotive Engines, in all, owned by Reading Railroad Company.

Condensed table, showing disposition of above Engines.

How Employed, or in what order.	Classes.			
	1*st.*	2*d.*	3*d.*	*Total*
In daily use in good order, on Reading Railroad, or Lateral Roads, in Coal Region	14	22	5	41
In Workships, under repair,	1	3	1	5
In good order, ready for use,	1	2	1	4
Altering and Rebuilding to more efficient Engines,	—	2	1	3
Out of use at present	—	1	—	1
Totals	16	30	8	54

EXTRACT FROM STATEMENT F.

Work and Repairs of all Locomotive Engines owned by the P. and R. R.R. Co., for the year ending Nov. 30th, 1845.

	1st class.	2d class.	3d class.	Total.
Total of all miles ran,	283,140	417,863	109,282	810,285
Total number of tons hauled one mile, not including engine or tender,				191,514,962
Average weight of loaded coal trains down, not including engine or tender,				509 1/16
Average weight of empty coal trains up, not including engine or tender,				179
Average weight of passenger train, not including engine or tender,				32 3/16
Oil used by engine and tender, with above coal train, per 90 miles, in qts.,				7 5/16
Oil used by engine and tender of passenger train, do.,				2 3/16

All tons of 2,000 lbs.

Repairs of above Engines.

Wages of all mechanics at repairs,	$ 16,406·29
Cost of all materials used, iron, steel, brass, &c.,	10,813·91
Superintendence, tools, oils, paints, &c.,	2,721·05
Total cost per year,	$ 29,941·25

Total number of miles ran by all engines owned by company from May, 1838, to present date,	2,270,965
Total number tons hauled one mile between same dates,	387,039,215

STATEMENT G.

Repairs and Renewals of Coal, Freight and Passenger Cars, on the P. & R. R.R., for the year ending Nov. 30, 1845.

Coal and Freight Cars.

Wages of all mechanics at repairs and renewals,	$ 20,070·98
Cost of iron, steel, brass, and all metals, &c.,	18,132·07
do. do. timber,	6,137·64
Superintendence, oil, tools, paints, &c.,	4,434·07
	$ 48,774·76
Number gallons oil used by Coal and Freight Cars, during year,	10,782
Number lbs. tallow,	31,732

Passenger Cars.

Wages of all mechanics at repairs, renewals and alterations,	$ 1,684·37
Cost of all materials,	1,961·08
Superintendence, oil, tools, paints, &c.,	466·88
	$ 4,112·33
Number gallons oil used during year,	184
do. lbs. Tallow,	670

STATEMENT H.

Items of Cost, in detail, of hauling Coal on the P. & R. R.R., for the year ending November 30, 1845.

Per round trip of 186 miles, from Coal Region to Tide Water, and back, with empty cars; transporting an average load of 295 tons of Coal.

Items of Cost.	No.	Descript'n.	Rate.	Am't.
Wages of Engineer,	2	Days	2·40	$4·80
Do. Fireman,	2	do.	1·32	2·64
Do. Conductor,	2	do.	1·40	2·80
Do. Brakemen,	5	do.	0·97	4·85
Wood for fuel,	12·62	Cords	3·50	44·17
Oil for Engine and tender,	3·6	Gallons	·90	3·24
Oil and tallow for cars,	295	Tons	·015	4·42
Repairs of Engine and tender,	186	Miles	·049	9·11
Do. for coal cars,	295	Tons	·058	17·11
Renewals of Sundries, Ropes, Lamps, &c.	295	do.	·006	1·77
Supplying water,	13	M. Gall's	·080	1·04
Use of assistant engine at Falls' Grade,	295	Tons	·011	3·25
Car Couplers, Greasers, Timekeepers, Despatchers, and Turning crews,	295	do.	·009	2·65
Allowance for Engines laying over, assistant Engines in snow storms, &c., broken trips, and sundry petty expenses,	295	do.	·0258	7·61
Equal to 37·1 cents per ton.				109·46

ANTHRACITE COAL TRADE OF THE UNITED STATES.

The following table exhibits the quantity of Anthracite Coal sent to market from the different Regions in Pennsylvania, from the commencement of the trade in 1820, to 1845 inclusive, with the annual increase, consumption, &c.

	SCHUYLKILL.			LEHIGH.	OTHER REGIONS.								
Years.	Canal.	Railroad.	Total.	Total.	Lacka-wana.	Pine grove.	Shamo-kin.	Wilkes-barre.	Aggregate.	Annual Increase.	Consump-tion.	Unsold April 1.	Sold on Canal & R.R.
1820				365					365				
1821				1,073					1,073	708			
1822				2,240					2,240	1,167			
1823				5,823					5,823	3,583			
1824				9,541					9,541	3,718			
1825	6,500		6,500	28,393					34,893	25,352			
1826	16,767		16,767	31,280					48,047	13,154			3,154
1827	31,360		31,360	32,074					63,434	15,837			3,372
1828	47,284		47,284	30,232					77,516	14,082			3,332
1829	79,973		79,973	25,110	7,000				112,083	34,567			5,321
1830	89,984		89,984	41,750	43,000				174,734	62,651			6,150
1831	81,854		81,854	40,966	54,000				176,820	2,086	177,000		10,048
1832	209,271		209,271	70,000	84,600				363,871	187,051	298,871	none.	13,429
1833	252,971		252,971	123,000	111,777				487,748	123,877	434,986	65,000	19,429
1834	226,692		226,692	106,244	43,700				376,636	Decre'se	415,186	117,762	18,571
1835	339,508		339,508	131,250	90,000				560,758	184,122	635,935	79,212	17,863
1836	432,045		432,045	146,522	103,861				682,428	121,670	632,428	4,035	21,749
1837	523,152		523,152	225,937	115,387	17,000			881,476	199,048	680,441	54,035	28,775
1838	433,875		433,875	214,211	78,207	13,000			739,293	Decre'se	788,968	255,070	30,390
1839	442,608		442,608	221,850	122,300	20,639	11,930		819,327	80,034	867,000	205,395	28,924
1840	452,291		452,291	225,288	148,470	23,860	15,505		865,414	46,087	973,136	157,622	41,223
1841	584,692		584,692	142,821	192,270	17,653	21,463		958,899	93,485	958,899	100,000	40,584
1842	491,602	49,290	540,892	272,129	205,253	32,381	10,000	47,346	1,108,001	149,102	1,158,001	100,000	34,619
1843	447,058	230,237	677,295	267,734	227,605	22,905	10,000	58,000	1,263,539	155,538	1,263,539	50,000	60,000
1844	398,443	441,491	839,934	377,821	251,005	34,916	13,087	114,906	1,631,669	368,130	1,631,669	50,000	90,000
1845	263,559	820,237	1,083,796	432,080	269,469	47,928	10,000	178,401	2,021,674	390,005		50,000	
	5,851,489	1,541,255	7,392,744	3,205,734	2,144,904	233,282	81,985	398,652	13,467,302				

In 1820, only 365 tons were sent to market. In 1830, the quantity had reached 174,734 tons; in 1840, 865,414; and in 1845, 2,021,674 tons. By this statement, it will be observed that the trade has more than doubled within the last five years.

AMERICAN PATENTS.

List of American Patents which issued in the month of April, 1845, with Remarks and Exemplifications. By CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an improvement in the *Mode of Regulating the Delivery of the Yarn in Power Looms;* Ben. Slingerland, Paterson, Passaic county, N. J., April 1.

The object of this improvement is to take the feed of the yarn by its own tension from the yarn beam, which is effected by passing the yarn from the yarn beam around three small rollers, arranged in the manner fully explained in the following

Claim—"What I claim as my invention and desire to secure by letters patent, is the mode of arranging rollers 1, 2 and 3, for the purpose of regulating the delivery of the yarn. The arrangement being such by placing one of the rollers between and above the other two, and carrying the yarn under roller No. 3, then over No. 2, and then under No. 1, and from thence to the heddles, so that the tension of the yarn draws the upper one upon the other two, to increase the bite on the yarn, and thus prevent slipping, all as herein described."

2. For an improvement in the *Mode of Dredging the Channels of Rivers,* &c; Henry McCarty, Pittsburg, Pa., April 1.

The nature and object of this improvement is fully pointed out in the following

Claim—"What I claim as my invention, and which I desire to secure by letters patent, is the before described mode of scraping the bottoms of rivers, by operating a floating scoop by power machinery, placed in a separate vessel, anchored on the opposite side of the river, said floating scoop being attached to an anchor up stream, so that the current will carry back the scoop to the opposite side of the river at the termination of every operation of said scoop, for a repetition of the action of the scoop; the vessel containing the engine being moved up or down stream as the work progresses by the power of the engine as described."

3. For an improvement in *Carriage Wheels;* Eliphalet S. Scripture, New York City, N. Y., April 1.

The object of this improvement is to arrange the spokes and hub in such manner as to afford a ready means of tightening the wheel when the spokes become loose by shrinking, which is effected by inclining the spokes either way from the plane of the wheel to form what is termed a double dished wheel, one half of the spokes being inserted in a permanent hub or cheek piece, and the other half in a movable hub, or cheek piece, which slides on the pipe box, so that by

In 1820, only 365 tons were sent to market. In 1830, the quantity had reached 174,734 tons; in 1840, 565,414; and in 1845, 2,021,574 tons. By this statement, it will be observed that the trade has more than doubled within the last five years.

means of a nut the movable hub can be forced with its spokes towards the other, and thus tighten the spokes.

Claim—"Having thus fully described my improvement, I wish it to be understood that I do not claim constructing wheels with the spokes bracing by projecting the inner ends out from the plane of the wheels on each side; nor do I claim screwing the ends up firmly against a centre permanent projection on the hub, as that would not effect the object I have in view, which is to continually tighten the spokes and brace them out against the felloes as they wear loose; but what I do claim as my invention and desire to secure by letters patent, is the combination of the pipe box with the cheek pieces into which the spokes are inserted, and fastened by plates on their outside, a space between said cheeks being left so that they can be forced towards each other to tighten the spokes as they wear loose, or shrink, and by that means firmly brace the wheel, which can be readily taken to pieces, and any broken or defective parts replaced by perfect ones."

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4. For an improvement in *Dies used in Padding Hoe Necks;* Nathan Brand, Leonardsville, Madison county, N. Y. April 1.

The permanent and movable dies have each a flat face for drawing the metal, a semicircular groove for rounding the neck of the rods, and a cutting edge for cutting off the piece when completed, so that the workman by shifting the piece of metal from one part to another of the same dies, (one of which is moved by a hammer,) can complete the forming of the metal preparatory to padding the hoe. The die for padding the hoe (which is operated on by a trip, tilt, or other hammer) is attached to a horizontally rotating stock to admit of turning, that any part of the die may be brought under the action of the hammer.

Claim—"What I claim as my invention and desire to secure by letters patent, is the combination of the die with the rotating stock, for the purpose and in the manner described. I also claim composing the die of the flat face, the groove, and the cutter as described, so as to perform with the same instrument the three operations of hammering, rounding, and cutting."

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5. For an improvement in the *Connecting Rods* for connecting the crank pins of three or more driving wheels of Locomotives; Holmes Hinckley, Boston, Mass., April 1.

The object of this improvement is to connect three, four, or more, driving wheels with a single connecting rod, and permit those between the two end ones to have a vertical and lateral play, which is effected by having the crank pins of the intermediate wheels work in boxes that slide vertically in the connecting rods, the said crank pins being made of sufficient length to give end play to the axles.

Claim—"I claim making the boxes to slide vertically in the connecting rod, in combination with extending or lengthening the crank pins of the wheels beyond the said boxes, so as to slide through them in the direction of their axes, as set forth; the whole being for the

purpose of converting all of the several wheels of the engine into drivers, as described.

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6. For an improved *Instrument for Cutting Grooves, or Indentations, through the bark and sap of Pine Trees, to procure turpentine*, called the "Double operating Turpentine Shave," Geo. R. Talley, Westbrook, Bladen county, N. C., April 1.

The following claim expresses the nature of this instrument very clearly.

Claim—"Having thus fully described the manner in which I construct my double acting turpentine shave, and pointed out the operation thereof, what I claim therein as new and desire to secure by letters patent, is the connecting of the two gouge-formed shaves, or cutters, with their levers, by means of the double springs, in combination with the concave guide band, by which combination the shaves, or cutters, are moved in a curve the reverse of that described by the ends of the levers from which they derive their motion; and I do hereby declare that I do not intend by this claim to limit myself to the precise form in which the instrument is herein represented and described, but to vary the same as I may find expedient, whilst I attain the same end by means substantially the same."

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7. For an improvement in the *Self Setting Apparatus for Saw mills;* Ben. Webb, Warren, Herkimer county, N. Y., April 1.

The lever, by which the log is set, is connected with the slide by an elongated hole playing on a pin, and to this lever is jointed a hand, or pawl, which takes into the teeth of a permanent rack, and to preserve the same inclination of the hand, or pawl, as the lever vibrates with it, there is a roller on the axis of the hand, or pawl, which travels between two rails. The toothed rack is adjustable by a screw, to set the apparatus for the first cut, to avoid the cutting of an imperfect plank at the first operation.

Claim—"I do not claim setting the head and tail block by means of a rack, pawl, and lever; but what I do claim is the before described combination of the railway and wheel with the sliding bar, hand, and lever, arranged and operated in the manner and for the purpose above set forth.

"I also claim the setting of the reversible cogged bar, by means of which it can be adjusted to the hand when reversed, or shifted, for cutting different thicknesses of boards in the same log, and thus avoid the necessity of spoiling the first board cut after shifting, or turning, the cogged bar as described."

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8. For an improvement in the *Axletrees of Wheeled Carriages;* James Jones, Galway, Saratoga county, N. Y., April 1.

This improvement is for a method of securing metallic skeins, or linings, to wooden axles, in such manner as to admit of turning them to change the worn part, for the part which is at the bottom

bears the whole weight, and consequently the principal part of the wear. The metallic lining is slipped on to the wooden arm, from the end of which projects an iron screw rod, that passes through a hole in the end of the lining, so that by a nut on the end, the whole can be secured, or turned, at any time.

Claim—"I do not claim to be the inventor of hollow skeins for axletrees, for these have been heretofore used, and secured permanently to the axletrees by bolts, or screws, passing through them into the axletrees; but what I do claim as my invention, and which I desire to secure by letters patent, is the before described manner of fastening the skeins to the axletree, so that they can be tightened, and turned, and changed in position whenever they become loose, or uneven, from the shrinking of the wood and the rubbing of the metallic surfaces, or from any other cause, by means of the aforesaid construction of the axletree and skeins, and arrangement of the screw rods and nuts, used and operated in the manner set forth."

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9. For improvements in the *Printing Press*; Joel G. Northrup, Cortlandville, Cortland county, N. Y., April 1.

The Patentee says—"In my press I employ four friskets, which are made to traverse up and down, being governed in their movements by suitable guides, and carried by pinions and ratchets, to be presently described. In their passage, two of them are simultaneously brought opposite to two forms of type situated vertically, between which and two platens they are arrested during the period necessary for taking the impression; the platens being brought up against them by a revolving shaft, furnished with arms, carrying friction rollers, and the impressions are thereby taken; at this time one of the friskets is situated above the platens, and the other below them; that above opening for the delivery of a perfected, and the feeding in of a blank sheet."

Claim—"I do not claim the using of four friskets as in itself new, but I claim the manner and combination in which I use them, which are necessarily different from any heretofore adopted; and these I claim whether the form, or forms, of type be placed vertically or horizontally, and whether two impressions, or one only, be taken at the same time.

"I also claim the manner of combining and arranging the parts by which the power is applied to the platens, through the intermedium of the revolving shaft, which is made to operate intermittingly, and to carry arms that bear upon the backs of the platens, as herein set forth."

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10. For a *Mooring Screw to be used as a substitute for Anchors*: Alexander Mitchell, Belfast, Ireland, April 1, 1845, to run fourteen years from the 4th of July, 1833, the date of the English Letters Patent.*

Claim—"And I declare my invention under the present letters patent to consist, in the application to the lower end of the wooden pile

*See vol. viii. 3rd series, 1844, p. 2, for a description of this Screw, with illustrations.

or to a metal pin, or shaft, of a broad metal screw, or worm, for the purpose of enabling such a pile, or pin, to be inserted into, or extracted from, the grooves, by causing it to turn upon its axes by means of cross levers, when it is placed with its point directed upon penetrable ground; and I claim under the privileges of the before mentioned letters patent, piles, pins, or shafts, so armed with broad metal worms, or screws, whether the same be employed for piling ground for the support of buildings or embankments, or to obtain a secure hold of the ground for the purposes of mooring, or holding fast, ships and other floating, or stationary, bodies.

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11. For improvements in *Power Looms*, for Weaving Plaids, Ginghams, &c; Erastus B. Bigelow, Boston, Mass., April 10.

The patentee says—"The nature of my invention consists in the mode of delivering out the warp, of taking up the finished cloth, and measuring it as it is woven. The method of constructing, arranging, and operating the shuttle boxes, arresting the shuttles, and then relieving their points from the pickers; thereby allowing the shuttle boxes to move up and down freely, and the method of stopping the loom when the filling breaks, or is exhausted."

Claim—"What I claim as my invention and desire to secure by letters patent is:

1st. The combination of the tension or yarn roller with the letting off motion, so that when the yarn roller is drawn forward by the process of weaving, the let-off is put in motion, which relieves the yarn roller and allows it to fall back, and thus stop the let-off, and I also claim in combination with the above, the break for preventing the yarn roller from moving, while beating up the cloth.

2nd. In combination with the measuring rollers, I claim the index wheel and hand for measuring the cloth as described.

3d. I claim the combination of the shuttle boxes with the weight, or spring, by means of the chain and pulleys and pin wheel with which the weight is made to connect to change the pattern, while the machinery is guarded against injury if the shuttle should not be sent home.

4th. I claim in combination with the pickers, the spring lever, arranged and operated as above described, so as to arrest the shuttle as it enters the box, and then to fall back to clear the point of the shuttle, before the box changes.

Lastly. I claim the combination of the apparatus for stopping the loom, that is to say, the combination of the fingered lever with the levers in the manner described, and in combination with the above, the protector and stop on the wheel, to arrest the motion of the crank shaft, and throw off the shipper.

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12. For an improvement in the *Horse Power, for driving Machinery*; Richard Montgomery, Sangerfield, Oneida county, N. Y., April 10.

Claim—"I am aware that bevel wheels have been made dishing, or

concave, for the purpose of permitting other wheels to turn within their peripheries, and I am also aware that a combination of wheels has been made in which the shaft of the last wheel passes through the shaft of the main, or master, wheel, and therefore I do not claim these as of my invention; but what I do claim and desire to secure by letters patent, is the arrangement of the bevel cog-wheels with the shaft of the last wheel passing through the shaft of the main wheel, in combination with the dished form of the main, or master, wheel, by which arrangement in combination the whole is rendered more compact than by any other with which I am acquainted."

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13. For a *Self Balancing Sliding Gate;* Aaron Baker, Western, Oneida county, N. Y., April 10.

Claim—"What I claim as my invention and desire to secure by letters patent, is running the self balanced gate on rollers, or pins, attached to the posts and between the rails of the gate, by means of which the counterpoise employed in railway draw bridges, as also a rail below or above in the passage of the gate, as in sliding doors, are dispensed with, whether this be applied with the rails of the gate horizontal or inclined to cause the weight of the gate to close it, as described.

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14. For an improvement in *Door Locks;* John Oxnard, Portland, Maine, April 10.

The tumblers of this lock when bolted, or unbolted, rest on the periphery of a metal block, (designated in the following claim by the letter D,) which is turned by a spindle. A portion of the periphery of this block is cut out, and a hole is made through the face for the insertion of a bit plate (designated by the letter G,) adapted to the proper movement to be given to the tumblers when carried around by the turning of the block, this apparatus answering the purpose of a key to increase the difficulty of picking.

Claim—"Having therefore described my improvements, I shall claim the revolving block and bit plate as applied to each other and to the bolt, and operating upon the bolt through a spring lever or other suitable contrivance connected to the bolt, the whole being substantially as herein above set forth.

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15. For improvements in the *Machine for Dressing Stones;* J. Keller, assignee of Daniel Pfister, Manedrof, Canton of Zürich, Switzerland, April 10, 1845, to run fourteen years from the 31st of Dec. 1844, the date of the European Patent.

The chisels are attached to a plate one behind the other, each in succession projecting a little more; and the plate has a short reciprocating movement, the plate being lifted up, for the return movement, by the rotation of two eccentric shafts that operate two lifters on which the plate slides.

Claim—"I claim first employing several cutting instruments at-

tached to a straight plate, and moving over a space equal to their distance apart, so as only to be in action a small portion of time before they are relieved, substantially as herein set forth; the cutters each projecting over the one below it the depth of the cut to be made, as above fully made known.

"Secondly, the method of moving the cutters from the stone after every cut, as herein described, by means of the revolving of the vertical shafts, or any other means substantially the same for the purposes herein described."

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16. For an improvement in the *Heating Apparatus for Portable Vapor Baths;* Thomas S. Lambert, Utica, Oneida county, N. Y. April 10.

In the pipe which rises from the boiler there is a hollow piston into which are placed the substances from which the medicated vapor is to be produced, and this answers the double purpose of furnishing the medicated vapor, and as a safety valve to regulate the pressure of the vapor from the boiler.

Claim—"The first claim is limited to the combination of the hollow piston, with the boiler, for the purpose specified. And the second, to the peculiar arrangement of the burners of the lamp employed to heat the apparatus, but which we do not deem sufficiently important to describe, as it could not be made clear without drawings."

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17. For an improved *Method of Tanning Leather;* Simon Snyder, Dayton, Montgomery county, Ohio, April 10.

Claim—"What I claim as my invention and desire to secure by letters patent, is the preparation of the hides, or skins, to be tanned, by puncturing or perforating them, either on the flesh or grain side, with holes extending either entirely or partly through, so as to admit the tanning more freely and perfectly, to penetrate and operate upon the skin or hide."

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18. For an improved apparatus for *Drying Bagasse, or refuse Sugar Cane;* Wm. White, assignee of Geo. Merrick, New Orleans, La., April 10.

Claim—"Having thus fully described the manner in which I construct and arrange my apparatus for drying bagasse, what I claim therein as new, and desire to secure by letters patent, is the combining with a steam engine, or other furnace, used in manufacturing sugar, of a horizontal range of triple flues, in such manner as that an endless apron, or bagasse carrier, may be made to traverse through two of the said flues, whilst the heated air and gaseous products of combustion, are made to pass through the third, or middle, flue, on its way to the chimney. The respective parts being arranged and operating substantially in the manner and for the purpose herein fully set forth."

19. For a *Submarine Telescope for examining objects under the surface of the water;* Sarah P. Mather, Brooklyn, N. Y., April 16.

A glass lamp is attached to the lower end of a tube for the discharge of the gasses, and small tubes by the side to supply air to the lamp for combustion. This constitutes the instrument for eluminating objects under water, and the telescope consists of a tube of sufficient length to reach from the surface of the water to any depth required, with an opening at one side of the lower end covered with glass, or a glass tube at the lower end may be substituted therefor. A reflecting mirror is placed back of this aperture to reflect any object under water, and two small tubes extend from the lower end to the large tube by the side of the glass tube or window, up to the water surface, to prevent the pressure of water from collapsing the large tube.

Claim—"Having thus fully described my improvements, what I claim as my invention, and desire to secure by letters patent, is the combination of the lamp, or other light, and tubes, substantially in the manner and for the purpose above described.

I also claim the telescope herein made known, having glass at its lower end, and a mirror therein, and side pipes attached thereto, the whole being combined and arranged as herein before made known."

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20. For an improved *Apparatus for giving hot air, or vapor, baths;* Joel H. Ross, N. Y., April 16.

The patentee says—"This apparatus consists of a fountain to contain the combustible fluid to be used, with a burner attached, at which the fluid is to burn; a boiler to contain the water by which the steam is to be generated; a frame which is to be placed around the patient to receive the bath, and a pipe to conduct the vapor and hot air from the boiler to the frame."

Claim—"What I claim as my invention, and desire to secure by letters patent, is the combination of the boiler with the steam and hot air pipes, having the communications between them regulated by the valve, the whole being constructed and operated as above described.

"I do not, however, intend to be understood as confining myself to the use of any particular metal, in the construction of my said apparatus, nor to the precise dimensions of the several parts thereof as above mentioned; these may be changed according as circumstances may require."

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21. For an improvement in the *Press for Pressing Cotton, &c.;* Jos. Slocum, Syracuse, Onondaga county, N. Y., April 16.

This press is adapted to the pressing of several bales at one time. A horizontal beam is carried up and down by means of two vertical screws, and operates a series of toggle joints connected with it, each toggle joint being provided with, and operating, two followers, on opposite sides, so that two series of bales, which are carried in on cars, are all pressed at the same time, and when corded up, can be drawn out.

Claim—"Having thus fully described my improvement in presses,

what I claim therein as new is the combination of the series of toggle joints with the beam, in the manner described, so that they can have a lateral motion, without straining the beam."

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22. For improvements in the *Locks of Pistols and other fire arms*, having several barrels connected together and revolving on one spindle parallel with the barrels; Ethan Allen, Norwich, Ct., April 16.

Claim—"Having therefore explained my improved pistol, I shall claim, extending the rear end of the dog, or catch, rearwards and beyond where it is jointed to the tumbler of the percussion hammer, and connecting the upper end of the main spring directly to the part so extended, or otherwise connecting the main spring to the dog, so as to cause it to operate upon the hammer, dog, and trigger, substantially as described; the same being for the purpose herein before specified.

Also, the combination of the fixed angular stud, with the dog, or catch, jointed to the tumbler, for the purpose of enabling a person to cock the percussion hammer, in the manner as above set forth.

Also, the piece of metal as combined with, or applied to, the sier of the trigger, and in front of the notch thereof, and hook of the catch, and operating upon, and in relation thereto in the manner and for the purpose as herein before explained.

Also, my new and peculiar arrangement of the pitman upon the sier of the trigger, in combination with the construction and arrangement of the teeth upon the breech, or rear end, of the cylinder, or series of barrels, by which improvement in constructing and arranging the aforesaid parts, I am enabled to very much simplify them, in comparison with the manner in which they have heretofore been made and disposed.

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23. For an *Argillous Mastic;* Wm. H. Chase, U. S. Corps of Engineers, April 16.

Claim—"What I claim as my invention and desire to secure by letters patent, is the substitution of red sand stone and clay, reduced to a powder, in their natural state, or argil, silex, and the oxide of iron, for the stone of Sessyl or Val du Travers, or other assimilated materials, in combination with the mineral tar of Sessyl, or with any other bitumens, used in the formation of mastics, or in the use of red sand stone alone with mineral tar or other bitumens.

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24. For an improvement in *Door Locks;* Rodolphus Kinsley, Springfield, Hampden county, Mass., April 16.

The latch bolt of this lock is let into and works within a recess made in the bolt lock.

Claim.—"Having thus fully described my improvement, what I claim as my invention and desire to secure by letters patent, is the so combining the latch bolt and bolt of the lock, as that one will slide within a groove in the other, in the manner and for the purpose herein set forth."

25. For an improvement in the method of *Constructing the Wheels of Carriages, Wagons, &c.;* Gershom L. Ackerman, Troy, Rensselaer county, N. Y., April 16.

The object of this improvement is to insert the tenons of two spokes in one mortise, so that they shall brace each other, instead of having a mortise for each separate spoke.

Claim.—"What I claim and desire to secure by letters patent, is the construction and use of wheels with two spokes in one mortise, in the manner and for the purpose above described."

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26. For an improvement in the *Drop Cut-off Valves of Steam Engines;* John Cochrane, Baltimore, Md., April 16.

This is for a modification of the checking apparatus, or what is known as the dasher and pot of the Sickles' cut-off valves, and consists in working the dasher attached to the stem of the valve within a steam dash pot, open at top for the free passage of steam, and having an aperture at the bottom governed by a valve to regulate the escape of steam, and consequently, the descent of the valve on its seat.

Claim.—"What I claim as my invention in this machine and desire to secure by letters patent, is the manner of using the dasher or piston that is attached to the stem of the steam valve in combination with and working within a short cylindrical vessel, or check chamber, which is open at top, to allow a free passage to the steam in and out, and is furnished with an adjusting slide to regulate the escape of the steam; by which means the valve is made to take its seat without striking or noise."

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27. For improvements in the *Auxiliary Steam Engine for supplying steam boilers with Water;* John Cochrane, Baltimore, Md., April 16.

The patentee says, "The intention of an auxiliary supply engine is not only to supply water to a boiler, but to preserve the same at a uniform height therein, without its being affected by any irregularity in the consumption or evaporation of that fluid; said auxiliary engine stopping and starting and working quickly, or slowly, as the demands of the boiler may require. Under the arrangement that I prefer, the admission of steam to the auxiliary engine is governed by a float and balanced valves, placed in a chamber outside the boiler, but communicating therewith by two branches, one above and the other below the water line; so that the water may have the same level both in the chamber and boiler. The float is furnished with a tubular stem at bottom, opening into it, for the purpose of carrying off any leakage; this stem passes out through a stuffing-box in the lower part of the chamber, the arrangement of this part being substantially the same with that represented and described in the specification and drawings accompanying letters patent of the United States granted to me on the 13th day of July, 1844, for regulating the supply of water in steam boilers. The float, however, may be otherwise arranged and modified, the only requisite being that its action on the steam valve should be governed by the height of water in the boiler.

"It is not pretended that an auxiliary engine for the supplying of water to steam boilers is in itself new, such engines having been heretofore employed for that purpose; but I have, as I believe, succeeded in so constructing and arranging the parts of such an engine as to obviate the main difficulties heretofore encountered in the attempts to employ them."

Claim.—"Having thus fully described the nature of my improvements in the auxiliary supply engine, what I claim therein as new and desire to secure by letters patent, is, first, the manner herein described of completing the stroke, or traversing motion, of the valve, by the commencing return stroke of the piston operating on the spring arms, substantially in the manner and for the purpose herein set forth.

"I likewise claim the manner of regulating the stroke of the water pump, by adjusting the same by means of a valve, or cock, as set forth, so that a smaller and regulated quantity of steam shall be admitted to the lifting, than is admitted to the forcing, side of the piston as described."

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28. For an improvement in the *Truss Frames of Bridges, &c.*, Geo. W. Thayer, Springfield, Hampden county, Mass., April 22.

Diagonal braces extend from the lower end of one post to the upper end of the next, and abutting against shoulders on the posts, and these braces are crossed by other braces pinned to the posts. And for the purpose of cambering the trusses, screw rods extend from post to post, above and below the junction of the posts and diagonal braces.

Claim.—"Having thus set forth my invention, I shall claim the combination of one or more series of iron screw rods with the suspension posts and chords, or string pieces, of a truss, in the manner and so as to operate substantially as herein above specified.

"I do not claim the combining with the posts, braces and strings of a truss, but what I do claim is the arrangement of such a series of braces upon the *outer sides of the truss*, and so that they shall extend above and below the chords thereof, and be confined to the truss, substantially as above described."

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29. For an improved mode of *Manufacturing India Rubber Cloth;* Nelson Goodyear, Newton, Fairfield county, Conn., April 22.

Claim.—"I claim as my invention, the method of rendering India rubber fabrics solid and substantial, for the uses and purposes mentioned, by impregnating and combining the gum with grit, iron, or other metal filings, or other hard substances, in the manner specified, and therefor I solicit letters patent."

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30. For an improved method of *adjusting the follower of Presses;* Daniel Goss, assignee of Joseph C. Colt, Catskill, N. Y., April 22.

The patentee says,—"The nature of my invention consists in attaching one or more hydraulic cylinders to the platen or follower of the press, and providing them with valves, so as to allow the plungers to work out and in the cylinder, according to the pressure on the

platen; the valve to be operated upon by the movement of the press, so that the platen will resist an increasing force as the power of the press increases more or less."

Claim —"Having thus fully described my application of the self-adjusting platen and shown its operation, what I claim therein as new and desire to secure by letters patent, is the *application* of the hydraulic cylinder to the platen of the toggle joint and other progress in power presses, whether it be by applying the cylinder direct to the platen, or through the medium of screws, or wedges, racks and pinions, or other analogous devices, so that through the medium of the spring and gearing attached to the press, an increasing weight is thrown upon the valve, so as to produce the desired effect upon the platen, the whole being combined and operating in the manner herein set forth."

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31. For obtaining an *Extract of Quercitron bark, called "Flavine," which contains the yellow coloring matter, and also the astringent portion of the said bark;* Geo. C. Close and Edward Field, Port Chester, Westchester county, N. Y., April 22.

Claim.—"Having thus fully described our process, we wish it to be understood that we do not claim extracting the tannin from the coloring matter in quercitron bark, as that has before been done by the introduction of gelatine, by which it is separated; but what we do claim as our invention and desire to secure by letters patent, is the process of evaporating the yellow coloring matter and tannin, or astringent matter of quercitron bark, substantially as here described; that is to say, by partially evaporating the decoction and then allowing the coloring matter to settle, and then drawing off the astringent liquid and preparing it for the uses intended."

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32. For a process for *Manufacturing an Oil from the residual tarry liquid of Rosin Gas Works;* Wm. T. Clough, Jersey City, N. J., April 22.

This oil is a compound of carbon and hydrogen, which is procured by the dry distillation of rosin, or from the residual tarry liquid of the rosin gas works.

Claim.—"I do not claim the particular form or description of apparatus, still, or retort. What I claim is the process, or mode of producing the American oil, as set forth in the above specification and drawings.

"Such apparatus may be modified or varied; as circumstances may require from time to time, as may be deemed expedient.

"What I claim is the process as herein above set forth, of producing the substance which I denominate the American oil, such process being conducted substantially in the manner described."

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33. For an improvement in *Saw Mills;* James Dane, West Derby, Orleans county, Vt., April 22.

The carriage of the saw mill is to be provided with two longitudinal

rails along the middle, with sufficient space between them for the passage of the saw, and transverse rest bars, to support the log, extend from these to the side rails of the carriage, so that by this means, the log and the board that is being sawed are supported from end to end.

Claim.—"Having thus concluded my description, I shall claim the employment and use of the longitudinal centre rail pieces and transverse rest bars, as combined with or applied to the rectangular carriage, and for the purposes as above described."

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34. For a *Self-acting Feeder for Printing Fabrics;* Alexander Boyd, Providence, R. I., April 22.

The patentee says,—"The peculiar object of my self-acting feeder, which is to be used in block printing of calicoes, mousselines de laine and various other fabrics, is to supply the sieve cloth, from which the blocks receive their color, or colors, with the requisite quantity of printing material, whether the same be of one or of several different colors, or of several shades of one color; and my mechanism is intended to supersede that which is generally employed, and which requires great nicety in its construction and use, but is very liable to accidental mixture of the several colors, and consequent loss of the same to the printer.

Claim.—"Having thus described my invention, I shall claim a feeder constructed of one or more troughs or apartments, and with the discharging orifices and adjustable valves adapted to them, the whole being for the purpose as hereinbefore set forth."

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35. For improvements in *Locks for doors, Bank vaults, &c.;* Henry C. Jones, Newark, Essex county, N. J., April 26.

This is for improvements in a lock patented by Wm. Hall, on the 17th of August, 1843, which has not yet been reached in our list of arrears, and as the present improvements could not be clearly understood without reference to the original patent, we will postpone all description of these until we notice Hall's patent.

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36. For an improvement in the *manner of preparing blocks or plates with raised designs*, for giving impressions in the manner of type or block printing; A.W. Thompson, of Philadelphia, Pennsylvania, April 26.

Claim.—"What I claim as constituting my invention in the above described process, and desire to secure by letters patent, is the preparing of designs in relief in copper, or other suitable metal, for the purpose of printing typographically, or for other purposes to which said designs are applicable, in the manner herein set forth of effecting the same, that is to say, by coating a block or plate of any suitable substance with a ground through which the lines of such design may be cut or traced, as set forth, and giving the same a coating of conducting substance, so that a plate in relief may be obtained therefrom by the electrotype process, as described."

37. For a *Machine for making the splints of friction matches*, and for inserting them in frames; Asa Fessenden, and Templeton and Luke Knight, Barre, Worcester county, Mass., April 26.

The claims in this patent refer to and are wholly dependent on the drawings, which are very complex. We are therefore under the necessity of omitting them.

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38. For a *Machine for Skimming Liquids;* C. Hearival, Baton Rouge, La., April 26.

The patentee says—"The nature of my invention consists in introducing into the liquid to be skimmed, a vessel having a flanch extending out horizontally on one side, with a rim standing up on its outer edge, as hereafter more particularly described; said vessel, by being revolved, skims the liquid, and receives the skimmings into the centre of the vessel.

Claim—"Having thus fully described my machine and its operation, what I claim as my invention and desire to secure by letters patent is the apparatus for skimming a liquid, by means of a vessel in which the scum is collected, by the revolution of the flanch, or sweep, forming a kind of spoon, acting down below, but very near the level of the scum, as set forth."

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39. For improvements in *Machinery for Weaving figured fabrics;* Wm. Townshend, Rochester, Strafford county, N. H., April 26.

The object of these improvements is to dispense with the jacquard frame in the weaving of figured fabrics, by substituting an endless belt of slats, provided with projecting pins, which throw in and out of play a series of hooks to which the harness, or mails, are suspended, so that such of the hooks are as thrown in the proper position, shall be lifted up by a vibrating frame at each operation, thus shifting the colors and figure.

We are under the necessity of omitting the claim, as it refers throughout to, and is wholly dependent on, the drawings, which are too complex for insertion here.

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40. For an improvement in the method of *Building vessels with movable Keels;* Thos. F. Griffith, New Market, Dorchester county, Md., April 26.

The permanent keel projects but very little from the bottom of the vessel, and to this is fitted the movable keel in such manner that it can be connected, or disconnected, at pleasure. Chains are attached to the upper surface of the movable keel which pass up to the deck through vertical tubes, and other chains attached to the side of the keel, extend around the outside of the vessel. When it is desired to put on the movable keel, the outside chains are liberated, and the inner ones drawn up, which brings the keel to the proper position, and it is there secured by means of vertical bolts which pass through the permanent, and enter the movable, keel. When these are all lib-

erated, the keel can be drawn up to the side of the vessel above the water line.

Claim—"Having thus fully described the nature of my improvement in building vessels, and shown the manner in which the same is carried into operation, what I claim therein as new and desire to secure by letters patent, is the manner of attaching a movable, to a stationary keel, and of shipping and unshipping the same, by means of bolts and chains, substantially as herein set forth.

Patents Re-issued for Amendment in the month of April, 1845.

For an improved *Method of supplying water to steam boilers* by means of an auxiliary steam engine; Isaac N. Coffin, Washington, D. C., April 26.

This patent was originally granted on the 30th of September, 1839, and noticed in this Journal in its appropriate place, to which the reader is referred for an explanation of the principle of the invention. The following is the amended claim.

"What I claim as new, and desire to secure by letters patent, is the combination of the float with the valve, steam engine, and supply pumps, substantially as herein described, so that the depression of the float, caused by a deficiency of water, shall open a valve, and that the steam which escapes through said opening shall drive an engine to operate the supply pumps.

List of American Patents which issued in the month of January, 1842. By Charles M. Keller, late Chief Examiner of Patents in the U. S. Patent Office.

Continued from page 326 of vol. x, third series.

13. For improvements in the *Mortising Machine*; Jerub A. Fay, Keene, Cheshire county, N. H., Jan. 17.

As the claim refers to, and is dependent on, the drawing, we are under the necessity of omitting it; but it is limited, first, to the peculiar manner in which the chisel shaft swivels on the part which connects it with the lever, by means of a spring catch, jointed to the chisel shaft, which catches into notches in the bridles that suspend the chisel shaft to the working lever. Second, to the combination and arrangement of parts for setting the chisel shaft farther from, or nearer to, the frame, by having the shaft slide in the heads of two parallel bolts, one near the top, and the other near the bottom; these bolts slide freely in the frame, and are connected together by means of an iron frame, through which passes a regulating screw, by the turning of which the chisel is set for any thickness of work. And, third, to the arrangement and combination of parts by which the depth of cut can be regulated at pleasure. This is effected in the following manner,—viz. The lever which operates the chisel is at top, and instead

of being connected directly with the treadle, there is an intermediate lever, connected with the treadle by a connecting link, or bridle, and this intermediate lever is connected with the upper lever by a bridle which embraces the two levers, and fits in notches in the upper part of one, and the lower part of the other. The lower face of the intermediate lever is inclined, and provided with several notches, so that by shifting the bridle from notch to notch the depth of cut will be regulated.

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14. For an improved *apparatus for Teaching Geography and Astronomy;* Robert Piggot, Elk Ridge Landing, Md., Jan. 17.

Claim—"What I claim therein as new, and desire to secure by letters patent, is the forming of celestial and terrestrial spheres, or of portions thereof, and of the lines representing the projections of such spheres, or of portions thereof, of wood or of other light materials, having the lines representing the greater and the lesser circles, or the outlines of constellations, cut into such spheres, or plane surfaces, and having the whole of the surfaces of such spheres, or portions of spheres, or plane surfaces, converted into artificial slates, being so coated and prepared as that pencil lines may be drawn upon, and erased from thence, substantially in the manner and for the purposes herein fully made known and described."

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15. For improvements in *Stoves for burning Anthracite Coal;* Stephen M. Allen, Boston, Mass., Jan 17.

Claim—"Having thus described my improvements, I shall claim as my invention the arrangement of two flues between the fire box and casing of an air tight stove, (formed by the rims arranged around the fire box, as described) communicating with each other by an opening in the lower rim at the front of the stove, for the purpose of causing the smoke and heated products of combustion to traverse twice around the red hot fire chamber, so that they may be effectually consumed, and all the heat they are capable of yielding may be derived from them, and also for the purpose of facilitating the process of combustion in the fire box, as above set forth. And I also claim the combination of the flues above mentioned, with the system of flues which conduct to the same, from the top of the stove, consisting of the flue pipe, the arched and column flues, and those about the ash pan, the whole being arranged and operating substantially as above specified."

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16. For improvements in *Machinery for Picking Oakum;* John Stansbury, and Wm. Ridgaway, Jr., Baltimore, Md., Jan. 17.

This consists of several machines and processes, combined together for the purpose of preparing and picking oakum.

The picking machine consists of a large toothed cylinder, which takes and tears the pieces of rope as they are presented to its action by an apron and feed rollers; and around this is arranged a series

of smaller picking and stripping rollers. The soaking and steaming apparatus consists of a box with a perforated bottom, into which the material is to be placed, which box is surrounded by a steam jacket. The breaker is a large toothed cylinder that rotates, within a casing, armed with corresponding teeth. The beater consists of heavy pounders that are moved up and down by tappets on a rotating shaft. The pieces of rope, &c., are placed on a platform to be acted upon by the beaters. The pressers are two large rollers that turn on arms projecting from a vertical shaft, by which they are carried around on a platform, which receives the pieces of rope to be pressed; and the knife for cutting the rope is attached to a sliding gate, like the old straw cutter.

Claim—"We claim as our invention and desire to secure by letters patent, the combination of the machine for picking, with the soaking, steam, and boiling apparatus, and breaker; the beaters, the pressers, and the knife; that is to say, we claim the combination of the picking machine with each of the other machines separately, and with the whole of them, for the purpose and in the manner described."

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17. For improvements in the *Roller Gin*; Ebenezer Carver, Bridgewater, Plymouth county, Mass., Jan. 17.

Claim—"What I claim as my invention, and desire to secure by letters patent, is the manner in which I have arranged and combined the feeding hand, having a forward and back motion, (whether the points of its fingers during said motion describe a right line or a figure somewhat elliptical), with the carriage grate, having an up and down motion, so as to co-operate with each other in feeding the cotton to the rollers of the roller gin in the manner herein set forth, whether they be used with the gauge and comb as herein before described, or with either or neither of them. And although in describing the foregoing machine, I have shown what I deem to be the best manner of communicating the required motion to the feeding hand and carriage grate, having found the same to answer well in practice, I do not intend to limit myself to the particular arrangements of the crank shafts, levers, bars, or connecting rod, as herein set forth, as the feeding hand and carriage grate may be made to operate in a similar way by means of cams, or other devices, well known to machinists, and I intend therefore to vary the arrangement of these parts in any manner which I may deem proper whilst the combination and operation of the feeding hand and carriage grate, for governing and regulating the feeding the cotton to the rollers, remains substantially the same with that herein fully made known.

I also claim as my invention, and desire to secure as aforesaid, the feeding hand as herein substantially described with respect to the rollers, claiming the same whether it be used with the grate for holding the seed cotton as herein described, or with any other grate, or apparatus, for holding said cotton, either moving or stationary, which is so considered as to allow the said motion of the fingers of the feeding hand to take the seed cotton to the rollers."

18. For an improvement in the ***method of Propelling Boats;*** Thos. W. Riley, McMinn county, Tenn., Jan. 24.

This is for an alleged improvement in the mode of propelling boats by means of jets of water, drawn in at the bow, and discharged at the stern, through tubes passing entirely through the vessel.

Claim—"What I claim as my invention and desire to secure by letters patent, is the combination of a chamber formed within the body of the boat, in which a wheel with spiral vanes revolves, at right angles to its progression, with tubes opening into it from the bow and stern, constructed as herein described. I also claim the employment of the stuffing boxes to admit of the expansion and contraction of the tubes, in the manner above specified.

"Third, I claim the employment of cut off valves in the end tubes beyond the stuffing boxes, as herein described, so that the water can be shut off for the purpose of repairing the tubes, wheel, &c. and by means of which the tubes can be used as buoys."

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19. For an improved ***mode of Dressing Leather;*** Wm. A. Ronald and Henry Miller, Rowan county, N. C., Jan. 24.

The patentees say—"The nature of our invention consists of a new mixture which we apply to the leather; the mixture is made by boiling together oil, bees-wax, tar, and resin-soap in the following proportions, viz: to every half gallon of oil, add 1 quart of tar, 4 ounces of bees-wax, and 4 ounces of resin-soap.

Claim—"What we claim as our invention is *not* the employment of a composition of bees-wax, oil, or tallow and tar for dressing leather, these having been a long time in use; what we *do* claim is the employment of resin-soap in combination with the articles specified, in the manner and for the purpose set forth. The advantage resulting from this new ingredient in the composition, is the saving of time and money, as the work can be sooner accomplished, and as there will be a saving of all the tallow heretofore used, and that the employment of the resin-soap has a tendency to make the surface of the leather more smooth, and that it renders it more impervious to snow, mud, and water."

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20. For an improvement in the ***Corn Sheller;*** Isaac Zellers, Greenwich, Warren county, N. J., Jan. 24.

In this machine the corn is shelled by a toothed cylinder rotating within a concave of staves, constructed as pointed out in the following

Claim—"What I claim as my invention and desire to secure by letters patent, is the connecting or uniting the staves of the concave to each other by a movable, or flexible, joint link, hinge bolt, or other movable, or flexible, connexion, made of iron or other material; by means of which arrangement, an independent motion of each particular stave is permitted, as well as of the whole concave. The whole being constructed substantially, and operating substantially as herein set forth."

21. For a *Hydrostatic Power Machine;* John Gregg, Rochester, Monroe county, N. Y., January 24.

The patentee says,—"There are many situations in which the power of water can be obtained under a very considerable head which, from local causes, cannot be rendered available by means of water wheels without an expenditure of money greater than could be made with prudence; it is principally in such situations that it is intended to employ the machinery invented by me. To effect this object, I employ two cylindrical or other formed water receivers, into which receivers, water is alternately admitted under any desired head, and is made by its pressure to condense atmospheric air, which air, so condensed, is to be conveyed by tubes to a cylinder furnished with a piston, valves, and other appurtenances, similar to those usually employed in a steam cylinder; the air being in fact substituted for steam in such manner as that an ordinary steam cylinder will not require any alteration to adapt it to use by means of condensed air."

We are under the necessity of omitting the claim, because of its reference to the drawings; but the reader will, from the above extract, be able to understand the nature of the improvement.

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22. For an improvement in *Chain Paddles for propelling boats;* Appleton Bragg, New York City, N. Y., January 24.

Claim.—"I do not claim to have invented any one of the several parts described as employed in this mode of arrangement and construction, the whole of such separate parts having been heretofore employed for similar purposes. But what I do claim as new and of my own invention, is the combination of a large sized wheel, or drum, having any number of straight sides on the periphery, with a smaller wheel having also any number of straight sides on the periphery, of the same size as those of the larger wheel; the two wheels being placed in such a relative position that the paddle-boards traveling on an endless chain beneath the two wheels shall successively leave the water in a position nearly vertical, by being raised out before they are turned up by the rotation of the smaller wheel, the whole being constructed and operating for the intended purposes substantially as hereinbefore described and set forth."

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23. For a *Machine for cleaning and polishing Cutlery;* Martin N. Armstrong, Williamsburg, Long Island, Kings county, N. Y., January 24.

This machine consists of two rotating brushes within a casing, the faces of the brushes being opposite each other, so that knives, forks, &c., introduced through apertures in the casing, are acted upon by both brushes at the same time.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the above described method of using the *double brushes, face to face*, for the purposes and in the manner shown as aforesaid."

24. For an improved method of *attaching Mops to handles;* Samuel S. Whitman, Little Falls, Herkimer county, N. Y., January 24.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the method herein described of holding mops by means of the inner jaw hinged, or jointed, to the sides of the outer jaw, and secured by rings, or links, substantially as described."

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25. For improvements in the *Steam Engine;* Ralph Pomeroy, Belleville, Essex county, N. J., January 24.

Within the cylinder of this engine there are four pistons, the two end ones being connected together and operating one crank; and of the other two, each operates a separate crank; and the three cranks being on the same shaft and dividing the circle into three equal parts. All the piston rods, except the last, are hollow, and pass through each other, and the steam is to be admitted alternately to the different pistons, and so cut off, that whilst it is expanding in one division, another division is receiving the steam directly from the boiler, but the manner of operating and arranging the valves for this purpose is not described or represented.

Claim.—"What I claim as my invention and desire to secure by letters patent, is combining four pistons, constructed and arranged substantially in the manner set forth, in one cylinder; said pistons being connected with three cranks placed at about an angle of 120° from each other, all as herein described."

SPECIFICATIONS OF ENGLISH PATENTS.

Specification of the Patent granted to WILLIAM KENWORTHY, *of the county of Lancaster, for his invention of certain improvements in looms for weaving.*—(Sealed December 12th, 1844.)

These improvements in looms for weaving apply solely to such as are worked by power, and particularly to that part of the power-loom known by the name of the "stop-rod," which is for stopping the loom, or throwing it out of gear with the driving-power, whenever the shuttle does not complete its course from one shuttle-box to the other. In ordinary power-looms this is effected by the shuttle acting against a "swell" in the shuttle-box, which communicates the required motion on the stop-rod, by means of a lever, bearing against the swell, and kept in contact with it by a spring. The great objection to this arrangement is, that the shuttle has to overcome the resistance of the spring, and also to raise the weight of the stop-rod lever at every "pick" or throw of the loom, which requires to have a heavy shuttle, a powerful pick, and a slow motion, to work successfully.

The present invention consists in working the stop-rod motion entirely separate from the shuttle by the motion of the slay or lathe alone, thereby relieving the shuttle from the burden of lifting the stop-

rod lever at every pick. By this improvement the patentee states, that he is enabled to drive power-looms at twenty or twenty-five per cent. faster than has been hitherto done, and with much greater safety to the working parts.

In Plate II., two methods are shown by which the required object, namely, working the stop-rod motion independent of the shuttle, may be effected. Fig. 15, represents a plan or horizontal view of the shuttle-box, and part of the slay of a power-loom for weaving, showing one of the improved arrangements; fig. 16, is a side view of the same; and fig. 17, is a side view of a different arrangement of mechanism, intended to effect the same object. *a*, *a*, is the end or main framing of the loom; *b*, *b*, part of the breast-beam; *c*, *c*, part of the slay or batten; *d*, *d*, the shuttle-box; and *e*, *e*, is the swell, which is acted upon by the spring *f*, *f*, and which is merely for the purpose of keeping the shuttle in its place in the box, and preventing its rebounding, by bearing against its side. The stop-rod, or shaft, *g*, *g*, is connected to, and works the spring-lever (for shifting the driving-strap), which is on the other side of the loom, and not shown in the drawings; on this shaft the stop-piece *h*, is keyed fast, which is furnished with a projecting tail-piece *i*, bearing upon a roller or bowl *k*, which revolves loosely upon a pin or stud *l*; *m*, *m*, is a lever or finger which, at every throw or pick of the loom, feels (as it were) whether the shuttle has arrived in the box or not: the shaft *g*, is furnished with two of these fingers *m*, *m*, one acting upon each shuttle-box.

The operation of the apparatus is as follows:—As soon as the batten or slay *c*, *c*, (in beating up) arrives directly over its centre, the shuttle *n*, is driven out of the shuttle-box *d*, across the loom; at the same time, or nearly so, the inclined portion of the tail *i*, of the stop-piece *h*, will have arrived over the bowl or roller *k*, which will allow the spring *o*, *o*, to exert its power to bring down the stop-piece *h*; at the same time causing the fingers *m*, *m*, at each end of the stop-rod *g*, to feel whether the shuttle is in either box; and if such be the case, the swell, bearing against the finger *m*, will not allow the spring *o*, to bring down the stop-piece *h*; but should the shuttle be absent from both boxes, the stop-piece *h*, will be brought down, and, by striking against the "frog" *p*, prevent the slay from beating up any further and injuring the cloth, at the same time that the stop-rod *g*, *g*, throws off the driving-strap and stops the loom.

In fig. 17, the action of the swell *e*, *e*, the finger *m*, and the stop-piece *h*, is precisely the same as in figs. 15, and 16,—the spring *o*, being placed behind the stop-rod *g*, and, consequently, always having a tendency to raise the stop-piece *h*, which is prevented from rising higher than is necessary to clear the frog *p*, by the stop *q*, fixed to the shuttle-box. It will be seen that the stop-rod *g* is, in this instance, furnished with a lever *r*, which, as soon as the shuttle has been driven across the loom, comes in contact with the lever *s*, vibrating upon its centre at *t*: this lever is connected to a spring *u*, which causes the fingers *m*, to try whether the shuttle is in the box, or not. If the shuttle is in either of the boxes, the spring *u*, will give

way ; but if the shuttle is in the race, the spring *u*, being stronger than the spring *o*, will bring down the stop-piece *h*, and throw the driving-strap upon the loose pulley. *v*, is a stop-pin, for the purpose of preventing the spring *u*, from drawing the lever *s*, further than the perpendicular line above its centre.

Another modification of this invention may be made, by reversing the arrangement shewn in figs. 15, and 16, that is, by placing the bowl or roller *k*, upon the stop-piece *h*, and the inclined plane upon the frog or framing of the loom; but the patentee prefers either of the former arrangements, as the additional weight of the roller upon the stop-rod would cause a great strain upon it, and require additional power.

The patentee claims the novel and peculiar construction and arrangement of mechanism or apparatus (or any modification of the same,) and the particular application thereof to power-looms, for the purpose above described, and in the manner represented in the drawing ; that is, working or performing the stop-rod motion entirely separate or distinct from the action of the shuttle, and effecting the same by the vibration of the slay or batten.—(*Inrolled in the Petty Bag Office, June*, 1845.)

Specification of the Patent granted to Arthur Wall, *of the County of Middlesex, for certain Improvements in the Manufacture of Steel, Copper, and other Metals.*—Sealed December 18, 1844.

To all to whom these presents shall come, &c., &c. My invention is connected with, or relates to, the manufacture of steel, copper, tin, and zinc, and their compounds. And first, as regards steel, I take the bars of wrought, or other, iron, of a description properly fit and suited to the manufacture of steel, and I place them in the usual boxes and furnace, and in this part of the process, I employ the same means and the same apparatus as are in known use under the denomination of a converting furnace. The bars of iron so intended for conversion are embedded in charcoal of the ordinary description, or in the carbonaceous substances in general and customary use. Or I take of charcoal of the ordinary description, six parts, to three parts of chalk of the ordinary description, and to each volume or quantity of one bushel in measure of the charcoal and chalk, taken in such proportions, and finely powdered, I add one or two pounds of zinc filings; I lay or spread the mixture on the bottom of the converting chamber, or I place them in a retort of due and proper capacity, properly set for fire, and a fire made sufficient to drive off the carbonic acid. The carbonic oxide thus generated is then directed upon the chamber in which the iron under process of conversion is placed, and such direction is continued during the time required for the conversion. Having thus prepared the carbonaceous bed in which the bars of iron intended for the process of conversion into steel are laid and inclosed, as in the modes and arrangements usually adopted, I next make the necessary arrangements as hereinafter described, for the transmission of a continuous current or stream of electricity through the bars; and I

continue such transmission during twelve or fourteen consecutive hours, or during a longer time, if a longer time be necessary, for the conversion of the iron into steel. This process of transmission of the electrical current or stream is made through each of the bars in succession, or through the whole of them simultaneously, or together, the object being to transmit such electrical current through the bars antecedent to, and during their conversion into steel. I effect such transmission by attaching an iron, copper, or other suitable metallic bar or wire to the extremities of the polar bars respectively, as hereinafter described, and then bringing the extremities of such wires out of the furnace, so that, at the proper time, a connexion may be made between such wires and those forming the poles or conductors of a voltaic apparatus or pile, and in this way, the electric circuit is so completed, that such electric current or stream may be made, as aforesaid, to traverse the bars during a longer or shorter time. In practice, I commence the process of transmitting the electricity when the bars have become of a red heat in the furnace, and I continue the process of so transmitting the electricity, until one of the pole bars, to which the battery is attached, is, by examination, found to exhibit the proper indications of a perfect conversion. Now, although in practice I prefer to use, as a source of the electricity required in these aforesaid processes, that form of galvanic or voltaic battery, or apparatus, commonly known under the denomination of Smee's battery; yet I would have it understood that I find any other source or modification of electricity of adequate power may be used with equal effect.

The aforesaid process is equally applicable to blistered steel, and to cast steel; and when applied to cast steel, the process is the same as that used in the electrization of any common bars of cast iron, as has been already described by me in the specification of certain letters patent for "Certain improvements in the manufacture of Iron," and granted to me, and bearing date at Westminster, the 18th November, in the year of our Lord 1843.

The practical object being to subject such metal to the action and effect of an electrical current or stream, while it is in fusion or in the stage of setting, and to a greater or lesser extent, during the term of its cooling down to the usual temperature of the atmosphere.

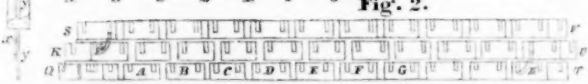
For producing the proper and effective conversion of steel in the process hereinafter described, I use a galvanic or voltaic battery, of the dimensions and arrangements as hereinunder stated. I construct a Smee's or other galvanic or voltaic battery, consisting of about 30,000 superficial inches of surface or area, and apply it for the conversion of each twelve tons of bar metal, and in the construction of such a Smee's or other battery for such purpose, the mode of arranging this quantity of superficial surface, which I find in practice the most commodious and effective, is to make each pair of plates of such battery to contain an acting surface of three hundred superficial inches under the dimensions for each plate of ten inches by five inches.

After having laid or spread the first stratum of carbonaceous matter in the converting chamber, as hereinbefore described, I arrange the

bars of metal to be operated upon in the following manner and order (that is to say) as such bars are represented in the annexed drawing. Fig. 1, represents a plan view of such arrangement, and Fig. 2, a view in perspective of several such horizontal arrangements placed over each other; the corresponding bars and supporting pieces in each of those figures being marked respectively with the same letter of reference, in as far as such, the said bars and supporting pieces, can be seen in those views. In Fig. 1, A, B, C, D, &c., represent a range of supporting pieces or blocks, and H, I, K, L, &c., an opposite range of similar pieces or blocks. In and between such supporting pieces or blocks of the respective range, I arrange the bars of metal to be submitted to the process hereinbefore described, in the order and manner of arrangement shown in the Figs. 1 and 2, respectively, the bars of metal being respectively marked *a*, *b*, *c*, *d*, &c.

Fig. 1.

Fig. 2.



Fig, 2, represents a mode of arranging the ranges of the bars of metal by super-position, which I find convenient and effective in practice. The lower range represented in fig. 2, at Q, T, shows in elevation the range Q, T, represented in fig. 1, in plan. The range represented in fig. 2, at K, U, shows a second range of similar horizontal arrangement to that shown in fig. 1; and in super-position to the first, the range represented in fig. 2, at S, V, shows a third range again, super-posed upon the second range, K, U, and I continue such ranges to any convenient extent or number of ranges. A pole-bar, *x*, *x*, and a trial-bar, *y*, *y*, is placed at each extremity of the ranges, and the ranges connected, as shown in the drawing at *z*, *z*. The whole of the interstitial spaces, or openings, remaining between the supporting pieces or blocks, A, B, C, D, must be filled up with refractory fire clay to the level of the upper side or surface of each such block. A horizontal layer, or stratum of the same, of about half an inch in thickness, is then laid upon the upper surfaces of the aforesaid pieces or blocks; and upon each such stratum so laid, the second range of pieces or blocks, as before described, are then arranged. The interstitial openings between the bars of metal under conversion are then to be entirely filled up with finely pounded charcoal or coke, mixed with finely pounded chalk, in the proportion of six parts of charcoal or coke, to two or three parts of chalk. This mode of filling the interstitial spaces between the bars of metal to be

converted, I employ for the lower range of such bars; the interstitial spaces between such bars in all the upper or super-posed ranges I fill with pounded charcoal, or coke alone. In applying my said invention to the other metals hereinbefore mentioned; that is to say, to copper, tin, and zinc, I subject the metals whilst in a fluid state, and also whilst in the act of congealing, or solidification, to a current of electricity, which I cause to traverse as completely as possible throughout the entire mass. The arrangements which I employ for that purpose are the same as those already described with reference to cast-iron, in the Specification of the letters patent, granted to me for "Certain Improvements in the manufacture of Iron," and bearing date at Westminster, the 18th day of November, (A. D. 1843), in the seventh year of her Majesty's reign, with this exception only, that in applying the electricity to copper, tin, and zinc, the connecting wire must be of platinum.

Having now described the nature of my said invention, and in what manner the same is to be performed, I wish it to be understood, that what I claim as the invention to be secured to me, in and by the hereinbefore recited letters patent, is the improvement in the manufacture of steel, copper, and other metals, and their compounds and other metals, by subjecting them while in a melting state, and in the process of solidification, to the influence of electricity as hereinbefore described.

MECHANICS, PHYSICS, AND CHEMISTRY.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

On several New Forms of Apparatus. *By* ALFRED L. KENNEDY.

Under this head it is proposed to describe from time to time philosophical instruments invented by the writer, which are believed to be new and advantageous.

1. *The Horizontal Double Cylinder Air Pump.*

Among the various forms of apparatus employed, none is more generally useful than the air pump. By it, the first and most familiar experiments of the school-room are exhibited. The most profound analytic chemist finds its frequent use necessary. Some instruments are valuable for purposes of illustration only, others are confined to the laboratory of research. The exhauster and condenser is indispensable to both. Any modification of, or improvement in, this instrument, therefore, is a matter of interest not only to the man whose sole pursuit is science, but to all who are engaged in studying or illustrating the simplest truths of experimental philosophy.

It is not a little extraordinary that while nearly every species of apparatus has been improved by modern ingenuity, the air pump retains the form given it by Boyle but a few years after the original invention by Guericke, and nearly two centuries ago. Hooke, Hawksbee, and Smeaton, enlarged, introduced metallic valves, and made it

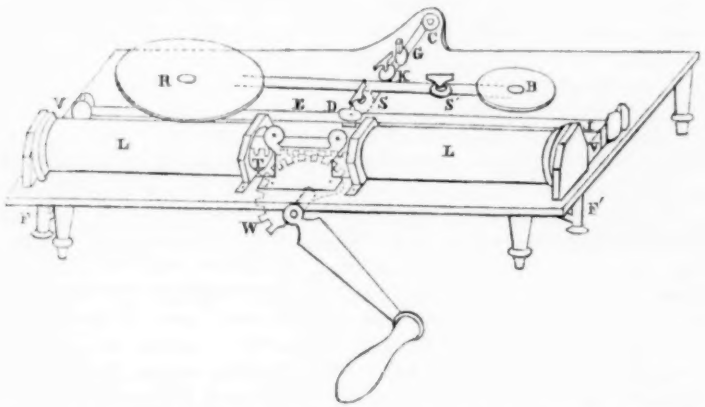
double acting, but they left its general appearance unchanged. Their improvements are not extensively employed, and if desired are as capable of application to the instrument figured below as to that of Boyle.

Probably all users of the common form have been made sensible of its want of stability and portability. These evils were sorely felt by the writer while engaged during the winter of '41 and '42, in lecturing in the northern part of the county. He determined, if possible, to remove them, and before the close of the season invented, and during the following summer constructed, the subject of this article. He employed it the succeeding winter in his course before the Delaware County Institute of Science, where it attracted much attention. It has been in use more than three years, and having received the unqualified approval of several impartial scientific men, and of one of the best makers of philosophical apparatus in the country, it is now for the first time made public.

The objections that obtain against the old form arise chiefly from the upright position of the barrels or cylinders. This necessarily throws the pinion twelve, or more, inches above the point of support. The handle placed on the projecting axis has a constant tendency, while the operator is working the pump, to tilt it outwards; so much so, as frequently during rapid exhaustion, to require the steadying hand of an assistant. This leverage outwards, and the consequent instability, are especially annoying whilst using the barometer gauge. Again, the most eligible height of table for the display of apparatus, by elevating the handle, renders the work of exhaustion an exceedingly laborious one, and the perpendicular cylinders and pump head form an inconvenient barrier between the operator and the glass receiver, especially if the experiment is performed on the gauge-plate: a footstool but poorly compensates for this height. Finally, the air pump, always one of the most expensive items of the laboratory, is rendered so, to some extent, by the cost of the double rack, pump head, and brass columns that support it. On each of the points named, the horizontal double cylinder pump is believed to possess great superiority.

Description.—In the figure L, L represent the barrels, the enlarged ends of which are let into the board and bolted through to ensure stability. There is *one* rack; the two pistons being attached to its extremities. A portion of the rack is exposed at T. The *semi* pinion W, works in cast straps, or gudgeons, attached to the bottom of the board by screws, which, passing through, terminate in the *rack guides*, one of which is seen above. The forward gudgeon is so cast as to receive the end of the *clamp* which secures the pump to the table. The semi-pinion works upwards through a slot cut in the board, and of course between the rack guides. The upper extremities of the guides are perforated to receive rollers, against which the back of the rack may work when necessary. None have yet been required. To the axis of the semi-pinion the handle is attached in the usual manner. The piston may be either solid or valved, and the cylinders may communicate with the plates R, and R, in the way most approved by the

maker. In the pump from which the sketch is taken, the pistons are solid. The farther extremities of the cylinders bear female screws, which connect with corresponding male screws on the block. On the posterior portion of each block is cut a female screw; the male of which bears the valve, of course opening inwards, v, v. On those portions of the blocks which project into the board are cut male screws bearing valves opening outwards. Perforated nuts over these secure the blocks to the board, and the valves against injury. At v, v is attached the tube leading from the plates. D is the screw for restoring atmospheric pressure. The general stop cock S, connects this with the parallel tube which, bearing the gauge cock S', forms at pleasure a communication between the plates.



The original of the figure both exhausts and condenses. The remaining letters refer to the parts used in condensing. This is effected by simply connecting, by means of tubes under the board, the valves F', F with a third tube passing upward to the stop cock K. Then the air drawn in at R, will be condensed in a receiver screwed on C. Those familiar with Pneumatic chemistry need not be told of the facilities thus afforded for the transfer of gases. The condensing gauge is borne by the screw G. To the working philosopher, it is unnecessary to amplify the advantages that result from lowering the centre of motion to a level with the points of support, bringing *both* plates directly under the operator's eye, and presenting, at about the cost of an ordinary exhausting pump, an instrument furnished with all the facilities for exhaustion, transfer and condensation, without any shifting of parts.

Philadelphia, December, 1845.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

On the Cleaning of the Wire Cylinder of the Safety Lamp. By Theodore F. Moss, Mining Engineer.

The ordinary method of cleaning the wire cylinder of the Safety

lamp by heating it over the flame of burning shavings, is capable of much improvement, as by this process it is found to become brittle, and consequently to impair the safety of using it. The coal dust, which contains more or less sulphur, combines with the oil and forms a tough mass, which hitherto has been taken off by the above way, but the wire becomes red hot and readily combines with the sulphur of the coal dust, and consequently becomes brittle and unsafe; in mines where there is much sulphur this is found a great inconvenience, and the cylinders must be renewed from time to time, if it is wished that they should retain the quality which their name implies.

In the Bulletin du Museé l'Industrie, it is proposed to clean the wire cylinders by washing them in a boiling solution of soda, which it effects fully, soap being formed by the combination of the oil and alkali. In Karsten's Archives of Mineralogy and Mines, the cleaning with soda is very strongly recommended, and the experience of several miners given, among which we may relate the following.

At the Gonley mines, in the district of Worms, the carbonate of soda of commerce is used, which contains 80 per cent. of soda, this, to be rendered caustic, requires an addition of unslacked lime. The soda is dissolved in water, in the proportion of one to ten, and one part of unslacked lime is added to four parts of soda; the whole is then raised to a boiling heat, the wire cylinder to be cleaned is left in the boiling solution about 6 minutes; in this short time the oil has fully combined with the soda, and the soap formed combined with the dirt, after which follows the brushing, rinsing, and drying. At the Gonley mine, 40 or 50 of these cylinders are placed at once in the solution, and at the same mines, daily, from 80 to 90 cylinders washed at the cost per week of 10 to 15 cents. The same liquid can be used for a length of time by the proper addition of water, soda and lime, especially if the undissolved precipitate is removed, or, better, if a filtered solution is used.

In the mining circle of Laurbruck, soda of commerce contains from 90 to 95 per cent. of soda. The solution is made of one part soda to eight of water, otherwise one proceeds as at the Gonley mine.

It is to be hoped that from the simplicity and cheapness of the process, it may be introduced at those mines in this country which may be under the disagreeable necessity of using the safety lamp.

TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Account of the process of M. M. Dechaud and Gualtier De Claubry, for the extraction of Copper from its Ores by Electricity.

The admirable researches of Becquerel upon the chemical actions effected under the influence of weak electrical currents, have opened a path destined to lead metallurgy to results of which we are even now unable to appreciate the full importance.

Having for their object the application of these actions to the extraction of Copper from its ores, M. M. Dechaud and Gualtier De Claubry have long been engaged in researches which they now con-

sider sufficiently matured to command attention, being destined to effect a complete transformation of the existing processes. The following is a brief account of their results reduced to the simplest form.

The extraction of Copper from pyritous ores is divided into two series of operations entirely distinct, the roasting the ore, and the precipitation of the copper.

The Roasting.—This is effected in a reverberatory furnace, either by the direct conversion of the sulphuret into sulphate by the sole action of the air, or else by another reaction of useful application which consists in the transformation of the oxide of copper into sulphate by calcining it with sulphate of iron, at a dull red heat in a current of air, the iron being left in the state of peroxide.

Suitable washing extracts the sulphate of copper, which contains neither arsenic nor antimony, so that the most impure minerals, as the *fahlers*, will afford copper equally pure with the carbonates or oxides of copper which contain no other metal.

The Precipitation.—The precipitation of copper from its solution requires, in the galvano-plastic processes, batteries of which the cost is far too great to be employed in metallurgy. It has therefore been attempted to obtain the same effect without the use of exterior batteries. The principle upon which the apparatus depends are these.

If we place, one over the other, two solutions, one of sulphate of copper, very dense, and the other of sulphate of iron, less dense, and in the first we place a plate of metal forming the cathode, and in the sulphate of iron a fragment of cast iron, and then unite these two metals by a conductor, the precipitation of copper commences at once, and is completed in a longer or shorter time according to the temperature, the concentration of the liquids, and the extent of the metallic surfaces. But as M. Becquerel has observed, the physical state of the copper undergoes great change as the liquid becomes weaker. We obviate this great difficulty by turning to profit the observation that after some minutes' action there exists four strata in the liquids; at the bottom we find the dense solution of sulph. copper, then a less dense solution of the same salt which has been deprived of its copper by precipitation; next is sulphate of iron become more dense by the solution of the cast-iron; and last, on the surface, the same salt in its original strength.

If, therefore, at the level of each of these strata we arrange suitable apertures for the addition or removal of the liquids in proportion as the chemical action goes on, we can easily preserve these liquids at uniform states of density and thus the copper is always pure and in the same physical condition.

In the application of this process to metallurgy, the extent of surface of land required to precipitate a large quantity becomes an important consideration; it is, however, easy to modify the form of apparatus, though preserving the same principle, so as to avoid this objection.

With this object we arrange the liquids in vertical instead of horizontal layers; they are now to be separated by a diaphragm very permeable to electricity but not to liquids. Paste-board answers per-

fectly for this purpose; it lasts for months without undergoing any alteration, and the quantity of sulphate of iron which penetrates into the sulphate of copper is still too small to effect the operation. The apparatus is therefore arranged in the following manner:

A chest of wood, lined with lead or some suitable mastic, contains the solution of sulphate of iron; through an opening near the top, we add the liquid until the proper degree of density is attained, while through a lower opening the saturated solution is allowed to escape.

Into this chest we plunge a number of cases, made of a frame having its ends and bottom formed of iron plate coated with lead; the sides are made of a sheet of paste-board. The strong solution of sulphate of copper enters through a pipe near the bottom, and escapes in its weak state through an opening at the top. *In* each case is placed a sheet of *leaded* iron; *between* each case and outside the end ones, are plates of cast iron. Separate rods connect each plate with the common conductor which is supported above the apparatus. Two large reservoirs of constant levels, receive the solutions and furnish them continuously. We adjust once for all the densities of the liquids and then the apparatus works on for whole months without requiring any kind of attention. The most convenient strength of the solution of copper which escapes from the apparatus is from one-fourth to one-half of a saturated solution. The copper is precipitated on both sides of the sheet of metal forming the cathode.

As the paste-board prevents the *immediate* contact of the two liquids, we effect this by making small holes through its upper edge, taking care that they are some distance above the highest part of sheets of metal forming the cathode; the sulphate of iron can thus float above the solution of sulph. copper, and the vertical apparatus now fulfills all the conditions of the horizontal one.

At a temperature of 20° Cent. 68° F.) one square metre (10·73 sq. ft.) of surface will receive as much as 1 kilogramme (15444 grs.) of copper in twenty four hours.

The precipitated copper is pure and is always in the same physical condition; the sheets obtained are fit for immediate working under the hammer, or to pass through the rolling mill, four or five passings through this gives the metal a density of 8·95; we therefore avoid all the operations required in the common process to reduce it from the form of bars to that of sheets. The manufacture presents no difficulties, requires no refining, and gives no scoria. In a regular manufacture as much as 75 per cent. of the copper has been obtained in the form of sheets, the remainder being precipitated, partly in pure fragments, and partly in powder of cementation. The authors consider as a metallurgical result, at the lowest 50 per cent. of the copper in sheets, 25 per cent. in fragments which only require fusion to be reduced into bars or plates; and 25 per cent. in powder requiring subsequent refining.

The question as to the applicability of galvanic action to the extraction of copper, appears to be reduced to the simplest possible

form. It is hardly necessary to remark that Electrotypes on the largest scale can be thus obtained.

A brief account of the Processes employed in the Assay of Gold and Silver Coins at the Mint of the United States. Written, by the DIRECTOR, *for the use of the Commissioners appointed to attend the Annual Assays.*

ASSAY OF GOLD COINS.

Principles of the operation.—According to law, the standard gold of the United States is so constituted, that in 1000 parts by weight, 900 shall be of pure gold, and 100 of an alloy composed of copper and silver.

The process of assay requires that the copper and silver be both entirely removed from the gold; and to effect this, two separate operations are necessary.

The first is for the removal of the copper; and this is done by a method, of very ancient date, called *cupellation;* which is conducted in an assay furnace, in a cupel composed of calcined bones, and by the aid of lead. It is founded on the property which this metal possesses of oxidizing and vitrifying under the action of heat; of promoting, at the same time, the oxidation of the copper; and of drawing with it, into the pores of the cupel, the whole of this metal, so as to separate entirely this part of the alloy, and to leave behind the gold and silver only.

The separation of the silver from the gold is effected by a process founded on the property possessed by nitric acid, of dissolving silver without acting upon gold. That this may be thoroughly accomplished, it is found necessary that there be an excess of silver over the gold, as otherwise the latter metal will cover and protect the silver from the action of the acid. Experience has shown that the silver present should be about three-quarters of the whole mass,—a condition which has given to the process the name of *quartation.*

Process of assay.—The reserved gold coins under trial are melted together and cast into a bar, from which a suitable piece is taken, flattened by a hammer, and rolled into a strip. From this strip pieces are cut, which, together, shall weigh exactly 1000 units. At this Mint, the unit weight employed in the assay of gold is *half a milligramme;* so that the whole weight submitted to assay is a *half gramme,* or about 7·7 grains.

Silver is next weighed out for the quartation; and as the assay-piece, if standard, should contain 900 units of gold, there must be three times this weight, or 2700 units of silver; and this is accordingly the quantity used. It is true that there is already some silver in the alloy, but a little excess over the quantity required for the quartation does no injury to the process.

The lead used for the cupellation is kept prepared in thin sheets, cut into square pieces, which should each weigh about ten times as much as the gold under assay.

The lead is now rolled into the form of a hollow cone, and into this are introduced the assay-gold and the quartation-silver, when the lead is closed round them, and pressed into a ball.

The furnace having been properly heated, and the cupels placed in it, and brought to the same temperature, the leaden ball, with its contents, is put into one of the cupels, the furnace closed, and the operation allowed to proceed, until all agitation has ceased to be observed in the melted metal, and its surface has become bright. This is an indication that the whole of the lead and copper have been converted into oxides and absorbed by the cupel.

The cupellation being thus finished, the metal is allowed to cool slowly, and the disk or *button* which it forms is detached from the cupel.

The button is then flattened by a hammer; is annealed by bringing it to a red heat; is laminated by passing it between rollers; is again annealed, and is rolled loosely into a spiral or coil called a *cornet*. It is now ready for the process of quartation.

For this purpose, it is introduced into a matrass containing about 4½ ounces of nitric acid, at from 20 to 22° of Baumé's hydrometer; and in this acid it isboiled for 20 minutes as indicated by a sand-glass.

The acid is then poured off, and about half the quantity of stronger acid, at 32°, is substituted for it, in which the gold is boiled for 10 minutes.

This second acid is then also poured off, and another equal charge of acid of the same strength is introduced, in which the gold is kept for 10 minutes longer.

It is then presumed that the whole of the silver has been removed, and the gold is taken out, washed in pure water, and exposed, in a crucible, to a red heat., for the purpose of drying, strengthening, and annealing it.

Lastly, the cornet of fine gold thus formed is placed in the assay balance, and the number of units which it weighs expresses the fineness of the gold assayed, in thousandths.

Test Assay.—To test the accuracy of this process, and to correct it if not exact, the following method is employed.

A roll of gold, of absolute purity, which has been kept under the seal of the Chairman of the Assay Commissioners, is opened in their presence, and from it is taken the weight of 900 units. To this are added 75 units of copper, and 25 of silver, so as to form, with the gold, a weight of 1000 units, of the exact legal standard.

This is passed through the same process of assay as the other gold, and at the same time. After the assay is finished, it is evident that the pure gold remaining ought to weigh exactly 900 units. If, however, from any cause, it be found to differ from this weight, and, therefore, to require a correction, it is assumed that the same correction must be made in the other assays, and this is done accordingly.

ASSAY OF SILVER COINS.

Principles of the operation.—The standard silver of the United States is so constituted, that of 1000 parts by weight, 900 shall be of pure silver, and 100 of copper.

The process of assay requires that the exact proportion of silver in a given weight of the compound be ascertained, and this is done by a method of recent date, invented by Gay Lussac, called the *humid assay*, which may be explained as follows.

The silver and copper may both be entirely dissolved in nitric acid; and if to a solution thus made, another of common salt in water be added, the silver will be precipitated in the form of a white powder, which is an insoluble chloride, while the copper will remain unaffected.

Now it has been ascertained that 100 parts by weight of pure salt will convert into chloride of silver just 184·25 parts of pure silver. Consequently the quantity of salt necessary to convert into chloride 1000 parts of silver, is 542·74 ; as found by the proportion,

184·25 : 100 : : 1000 : 542·74.

A *standard solution* of salt is accordingly so prepared, as that a certain volume of it, (the *décilitre*,) measured in a glass vessel constructed for the purpose, (called *the large pipette*,) shall contain 542·74 unit-weights of salt, and be therefore capable of precipitating, in the state of chloride, 1000 units of silver. The unit-weight employed at the Mint, for silver assays, is the French *milligramme*, a thousand of which, or the *gramme*, correspond to about 15·4 grains.

To precipitate *one* unit of silver, it is evident the one-thousandth part of the above measure of the standard solution would be required. But as this volume would be inconveniently small, it has been deemed proper to increase it ten-fold, by the use of what is called the *decimal solution*, which is made by adding to any portion of the former nine times its volume in water, and thus reducing its strength to one-tenth. This decimal solution is used in finishing the assays, and the portions required for precipitating unit-weights of silver are measured by a graduated glass tube, called *the small pipette*.

In the mode of assay under consideration, it is necessary that the portion of the alloyed silver used shall contain, as nearly as may be, 1000 units of pure silver. The rigid standard requires, that of 1000 parts by weight, 900 shall be of pure silver; but the law allows a variation from this ratio, provided that it do not exceed three thousandths. The fineness may, therefore, be as low as 897, and as high as 903. In the practice of the assay, it is found most convenient to assume the lower extreme. Now the weight of metal, of the fineness 897, which would contain 1000 units of silver, is 1114·83 ; as found by the proportion,

897 : 1000 : : 1000 : 1114·83

The nearest integer to this number is employed, and the weight of metal taken for the assay is 1115.

Process of Assay.—The reserved silver coins under trial being melted together, a portion is cut off from the bar, and is flattened and rolled into a thin strip, in order to facilitate the weighing and the solution. From this strip the weight of 1115 units is taken, and is intro-

duced into a glass bottle with nitric acid, in which it is completely dissolved.

Into this solution the large pipette-ful of standard solution of salt is introduced, and it produces immediately a white precipitate, which is chloride of silver, and which contains of the metallic silver 1000 units.

To make this chloride subside to the bottom of the vessel, and leave the liquid clear, it is necessary that it be violently shaken in the bottle; and this is accordingly done, by a mechanical arrangement, for the necessary time.

Unless the coins have chanced to be below the allowable limit of standard, the liquid will still contain silver in solution, and accordingly a portion of the decimal solution is introduced, from the small pipette, capable of precipitating a unit (and sometimes two or more) of silver, and a white cloud of chloride will show itself. The liquid is again shaken, and cleared; and the process is thus repeated, until the addition of the salt water shows only a faint trace of chloride below the upper surface of the liquid.

Let us suppose, for the sake of an example, that three measures of the decimal solution have been used with effect. This will show that the 1115 units of the coin contained 1003 of pure silver; and thus the proportion of pure silver in the whole alloyed metal is ascertained.

Test Assay.—For the foregoing process to be exact, it is necessary that the saline solution be of the true standard strength, or be such that the quantity of it measured in the large pipette shall be just sufficient to precipitate 1000 units of silver. This cannot be assumed without proof; and a test assay is accordingly made, as follows, by which the other assays may either be confirmed or corrected.

A roll of silver, known to be of absolute purity, is kept, from year to year, in an envelope, under the seal of the chairman of the Assay Commissioners. This being opened in their presence, a portion of the silver is taken, and 1004 units carefully weighed off, and submitted to the process of assay described above. If the salt water used be of the exact standard, it is evident that as the solution in the larger pipette will precipitate 1000 parts of silver, four measures of the decimal solution will be required to precipitate the remaining four parts, and if this prove to be the fact, the other assays are confirmed. But if the measures of the decimal solution required fall short of four, by any number, it is evident that the same number must be added to the other assays; and if, on the contrary, the measures required exceed four, by any number, the same number must be subtracted from the other assays.

Calculation of Fineness.—By the assay, thus corrected, the number of units of silver contained in 1115 units of the metal under trial, is ascertained; and the fineness, in thousandths, is then found by the proportion: As 1115 is to the number of units of pure silver, so is 1000 to the fineness of the alloyed silver, in thousandths.

Thus, if the assay show the presence of 1005½ parts of pure silver,

the fineness of the alloyed silver will be 901.8 thousandths, as found by the proportion,—

1115 : 1005·5 : : 1000 : 901·79.

It is on this principle that the following table is constructed. The numbers at the top and the fractions at the side correspond to the measures of the decimal solution used, corrected by the test assay. The numbers in the body of the table show the corresponding fineness of the assay-piece, of which the weight was 1115 units.

	0	1	2	3	4	5	6
0	896·9	897·7	898·6	899·6	900·4	901·3	902·2
¼	897·1	898·0	898·9	899·8	900·7	901·6	902·5
½	897·3	898·2	899·1	900·0	900·9	901·8	902·7
¾	897·5	898·4	899·3	900·2	901·1	902·0	902·9

On Artificial Ultramarine. *By* John Stenhouse, *Ph. D.*

Till within the last twelve or fifteen years the only source of this beautiful pigment was the rare mineral, *lapis lazuli*. The price of the finest ultramarine was then so high as five guineas the ounce. Since the mode of making it artificially has been discovered, however, its price has fallen to a few shillings the ounce. Artificial ultramarine is now manufactured to a considerable extent on the Continent, but as far as I can learn, none has as yet been made in Great Britain. The chief French manufactories of ultramarine are situated in Paris; and the two largest ones in Germany are those of Meissen in Saxony, and of Nuremberg in Franconia. Three kinds of ultramarine occur in commerce, the blue, the green, and the yellow. The first two only are true ultramarines, that is, sulphur compounds; the yellow is merely chromate of baryta.

Both native and artificial ultramarine have been examined very carefully by several eminent chemists, who, however, have been unable to throw much light upon their true nature. Chemists have undoubtedly ascertained that ultramarine always consists of silica, alumina, soda, sulphur, and a little oxide of iron; but no two specimens, either of the native or artificial ultramarine, contain these ingredients in at all similar proportions. In fact the discrepancies between the analyses are so great as to render it impossible to deduce from them any formula for the constitution of ultramarine; if indeed it does possess any definite composition. The following are a few specimens of these analyses, and others equally discordant might easily be added.

Lapis Lazuli.	*By Clement and Desormes.*	*Lapis Lazuli.*	*By Varentrap.*
Soda,	23·2	9·09	
Alumina,	24·8	31·67	
Silica,	35·8	45·50	
Sulphur,	3·1	0·95	
Carbonate of Lime,	3·1	3·52	Lime.
		0·86	Iron.
		0·42	Chlorine.
		5·89	Sulphuric acid.
		0·12	Water.

Parisian Artificial Ultramarine. *By* C. G. Gmelin.		*Meissen Artificial Ultramarine.* *By* Varentrap.	
Soda and Potash,	12·863	21·47	
Lime,	1·546	1·75	Potash
Alumina,	22·000	0·02	
Silica,	47·306	23·30	
Sulphuric Acid,	4·679	45·00	
Resin, Sulphur, and Loss,	12·218	3·83	
		1·063	Iron.

The last chemist who has examined ultramarine is Dr. Elsner, who has published a very elaborate paper upon it in the 23rd number of *Erdmann's Journal* for 1841. The first part of Dr. Elsner's paper is historical, and contains an account of the accidental discovery of artificial ultramarine by Tassart and Kuhlman in 1814, and of the labors of subsequent chemists. He then gives a detailed account of his own experiments, which have been very numerous, and from these he deduces the following conclusions: 1st, That the presence of about one per cent. of iron is indispensable to the production of ultramarine; he supposes the iron to be in a state of sulphuret. 2nd, That the green ultramarine is first formed, and that as the heat is increased it passes by degrees into the blue. The cause of this change is, he affirms, that part of the sodium absorbs oxygen from the atmosphere, as the operation is conducted in only partially closed vessels, and combines with the silica, while the rest of the sodium passes into a higher degree of sulphurization. Green ultramarine therefore contains simple sulphurets, and blue, polysulphurets.

Dr. Elsner's paper does not, however, furnish any details by which ultramarine could be manufactured successfully on the great scale. Thus, for example, in regard to the necessary degree of heat, perhaps the most important circumstance in the process, he gives no directions whatever. We know, however, from other sources, that it should be a low red heat, as at much higher temperatures both native and artificial ultramarine soon become colorless. Dr. Elsner, indeed, does not affirm that he was able to procure ultramarine in quantity of a uniformly good color. In fact the process of Robiquet, published nearly ten years ago, is the best which scientific chemists possess, though undoubtedly, the manufacturers have greatly improved upon it. Robiquet's process consists in heating to low redness a mixture of one part porcelain clay, one and a half sulphur, and one and a half

parts anhydrous carbonate of soda, either in an earthenware retort or covered crucible, so long as vapors are given off. When opened the crucible usually contains a spongy mass of a deep blue color, containing more or less ultramarine mixed with the excess of sulphur employed, and some unaltered clay and soda. The soluble matter is removed by washing, and the ultramarine separated from the other impurities by levigation. It is to be regretted, however, that the results of Robiquet's process are by no means uniform; one time it yields a good deal of ultramarine of excellent quality, and perhaps, at the very next repetition of the process in circumstances apparently similar, very little ultramarine is obtained, and that of an inferior quality.

The fabrication of ultramarine is a subject which well deserves the attention of English chemical manufacturers, as it could be carried on with peculiar advantage in this country. The chief expense of the process is the fuel required, which can be purchased in Great Britain for less than half the money it would cost either in France or Germany.—*Proceedings of the Glasgow Philosophical Society.*

Lond. Mech. Mag.

Improvements in Photography. By W. H. Hewett.

My attention has lately been directed to ascertain what other substances besides chlorine and bromine, separately and combined, possessed the property of accelerating the action of light on a Daguerrean, or iodized, plate; and after many trials, I found that the vapor of ammonia possesses this singular quality in a very remarkable degree. I first employed it with iodine alone, by simply iodizing a plate to a full yellow color, and then exposed it for a few seconds to the vapor of ammonia in an exceedingly attenuated state by adding a few drops of strong ammonia to a little water, just sufficient to recognise it by its odor; thus prepared it was placed in the camera, and produced a perfect impression of a building in half a minute in moderate sunshine; and several other experiments satisfied me that ammoniacal vapor has a very quickening action on iodine alone. My next step was to ascertain how it would operate with bromine; expecting it would either destroy or accelerate its action, I was rejoiced to find that it had the latter effect, and that plates prepared in the usual manner, with iodine and simple bromine water, are rendered infinitely more sensitive by exposing them a few seconds to this vapor than they are without it. Having found that I could obtain a perfect impression in sunshine instantaneously, and that five or ten seconds only were sufficient in a moderate light, I indulge the hope that, with its assistance, moving objects may therefore be taken with facility. I should inform you that I have employed this substance in a variety of shapes, by exposing the plates to its influence previous to placing them in the camera, or by allowing it to be envolved in it during the operation, or just before it is used, and in each case have found it equally efficacious. What is remarkable also, the accelerating influence of the ammonia seems to be retained in the camera for a considerable time, notwithstanding its volatility; in fact I have sometimes thought

its presence in the operating room alone had an accelerating influence, and am persuaded it will be highly advantageous in a room where bromine or iodine is envolved, whose presence is known to suspend the action of light altogether; this vapor, on the contrary, neutralizes them, and instead of retarding the process, hastens it.

I have not had time to institute further experiments, which I think the subject well worthy of. My object now is simply to direct the attentions of photographists and the scientific world to the fact, and I shall be much mistaken if this compound of hydrogen and nitrogen does not prove a valuable adjunct to the photographic art.

P. S. I should add that my experiments were made with two meniscus lenses of small aperture in front, and worked at the chemical, not the visual, focus with achromatic glasses. I have no doubt much more satisfactory results may be obtained.

Lond., Ed. and Dub. Philos. Mag.

Means of Consuming the Smoke from Furnaces.

Several persons were lately fined 40*s.* each at the Manchester Borough-court, for not consuming the smoke of their steam engine furnace. It appears from report of the proceedings in the *Manchester Guardian*, that the question of the practicability of greatly diminishing, if not altogether extinguishing this evil, was set at rest by the evidence of Mr. Henry Houldsworth and Mr. Thomas Ogden, the chimneys of whose works have long set an example to the district. Mr. Houldsworth stated, and, as far as such matters can be proved in a court of justice, proved, that the means essential to an almost perfect combustion of smoke were by no means costly; that, in ordinary cases, they might be applied at a cost of 10*l.* or 15*l.*; and that the result, while it secured all that could be desired in the removal of the nuisance, was in his case attended with a saving in his consumption of fuel of not less than 18 per cent. In three years 1838-1840, his consumption of coal was one ton per hour; in 1841 the smoke consuming apparatus was adapted to his furnace, and in the three following years, 1842-1844, his consumption of coal was reduced to 16 8-10ths cwt. per hour. The general accuracy of these statements, impugned by Mr. Armstrong, was confirmed by Mr. Fairbairn, C. E., who stated that two simple elements only were needed to ensure the consumption of smoke—a sufficiently high temperature, and the admission to the furnace of a sufficient quantity of atmospheric air. Some attempt was made to contravene the statements of Mr. Houldsworth, on the ground that his experiments, made some time ago, were fallacious; but it was observed, that three years of practice and experience take from the trial the character of an experiment, and leave it in the position of a well-established fact.

Mech. Mag.

On the Magnetization of Light, and the Illumination of Magnetic Lines of Force. *By* MICHAEL FARADAY.

For a long time past the author had felt a strong persuasion, derived from philosophical considerations, that among the several powers of nature which in their various forms of operation on matter produce different classes of effects, there exists an intimate relation; that they are connected by a common origin, have a reciprocal dependence on one another, and are capable, under certain conditions, of being converted the one into the other. Already have electricity and magnetism afforded evidence of this mutual convertibility; and in extending his views to a wider sphere, the author became convinced that these powers must have relations with light also. Until lately his endeavors to detect these relations were unsuccessful; but at length, on instituting a more searching interrogation of nature, he arrived at the discovery recorded in the present paper, namely, that a ray of light may be electrified and magnetized; and that lines of magnetic force may be rendered luminous.

The fundamental experiment revealing this new and important fact, which establishes a link of connexion between two great departments of nature, is the following. A ray of light issuing from an Argand lamp is first polarized in the horizontal plane by reflexion from a glass mirror, and then made to pass, for a certain space, through glass composed of silicated borate of lead, on its emergence from which it is viewed through a Nichol's eye-piece, capable of revolving on a horizontal axis, so as to intercept the ray, or allow it to be transmitted alternately, in the different phases of its revolution. The glass through which the ray passes, and which the author terms the *dimagnetic*, is placed between the two poles of a powerful electro-magnet, arranged in such a position as that the line of magnetic forces resulting from their combined action shall coincide with, or differ but little from the course of the ray in its passage through the glass. It was then found that if the eye-piece had been so turned as to render the ray invisible to the observer looking through the eye-piece before the electric current had been established, it becomes visible whenever, by the completion of the circuit, the magnetic force is in operation; but instantly becomes again invisible on the cessation of that force by the interruption of the circuit. Further investigation showed that the magnetic action causes the plane of polarization of the polarized ray to rotate, for the ray is again rendered visible by turning the eye piece to a certain extent; and that the direction of the rotation impressed upon the ray, when the magnetic influence is issuing from the south pole, and proceeding in the same direction as the polarized ray, is right-handed, or similar to that of the motion of the hands of a watch, as estimated by an observer at the eye-piece. The direction in which the rotation takes place will, of course, be reversed by reversing either the course of the ray or the poles of the magnet. Hence it follows that the polarized ray is made to rotate in the same direction as the currents of positive electricity are circulating, both in the helices composing the

electro-magnet, and also in the same direction as the hypothetical currents, which, according to Ampère's theory, circulate in the substance of a steel magnet. The rotary action was found to be always directly proportional to the intensity of the magnetic force, but not to that of the electric current; and also to be proportional to the length of that portion of the ray which receives the influence. The interposition of substances which occasion no disturbance of the magnetic forces produces no change in these effects. Magnets consisting only of electric helices act with less power than when armed with iron, and in which magnetic action is consequently more strongly developed.

The author pursues the inquiry by varying in a great number of ways the circumstances in which this newly-discovered influence is exerted; and finds that the modifications thus introduced in the results are all explicable by reference to the general law above stated. Thus the effect is produced, though in a less degree, when the polarized ray is subjected to the action of an ordinary magnet, instead of one that derives its power from a voltaic current; and it is also weaker when a single pole only is employed. It is, on the other hand, increased by the addition of a hollow cylinder of iron, placed within the helix, the polarized ray traversing its axis being then acted upon with great energy. Helices act with equal power in any part of the cylindric space which they enclose. The heavy glass used was found to possess in itself no specific magneto-inductive action.

Different media differ extremely in the degree in which they are capable of exerting the rotary power over a polarized ray of light. It is a power which has no apparent relation to the other physical properties, whether chemical or mechanical, of these bodies. Yet, however it may differ in its degree, it is always the same in kind; the rotation it effects is invariably in one direction, dependent however, on the directions of the ray and of the magnetic force. In this respect it differs essentially from the rotary power naturally possessed by many bodies, such as quartz, sugar, oil of turpentine, &c., which exhibit the phenomena of circular polarization; for in some of these the rotation takes place to the right, and in others to the left. When, therefore, such substances are employed as dimagnetics, the natural and the superinduced powers tend to produce either the same or opposite rotations; and the resulting effects are modified according as they are cumulative in the former case, and differential in the latter.

In the concluding section of the paper, the author enters into general considerations on the nature of the newly-discovered influence of electricity and magnetism over light, and remarks that all these powers possess in common a duality of character which constitutes them a peculiar class, and affords an opening which before was wanting for the appliance of these powers to the investigation of this and other radiant agencies. The phenomena thus brought to light confirm the views entertained by the author relative to the constitution of matter as being spheres of power, for the operation of which the conception of a solid nucleus is not necessary; and leads to the presumption that the influence of magnetism on bodies which exhibit no magnetic pro-

perties consists in producing in them a state of electric tension tending to a current; while on iron, nickel, and other bodies susceptible of magnetism, currents are actually established by the same influence.

The author states that he is still engaged in the prosecution of these inquiries. Lond. Rep. Pat. Inv.

Extracts from the Proceedings of the Paris Academy of Sciences.

(From the London Athenæum.)

Pyramids of Egypt.—*Oct.* 27.—M. Persigny, whose communication some months ago, relative to the object of the construction of the pyramids of Egypt, excited much notice by its novelty, has sent another communication on the subject. In his first paper, M. Persigny expressed an opinion that the pyramids were erected for the defence of the valley of the Nile against the eruptions of the sand of the desert. A simple wall, says the author, would have been only a temporary obstacle, which the winds would soon have surmounted; but the pyramids are of a form and arrangement which oppose to the current of air a resistance equal to the rate at which it displaces the sand, consequently the siliceous particles, having no support, fall at a considerable distance from the wonderful buildings established by the Egyptians. M. Persigny now presented the result of several experiments made by him, on a small scale, in support of the theory which he had advanced. A small ventilator represents the winds of the desert, and on a plank covered with sand, are little pyramids in paste-board. With this small apparatus, M. Persigny describes all the effects which he supposes to result from the gigantic monuments of Egypt.

New Planet Uranus.—*Nov.* 10.—A paper, by M. Leverrier, on the planet Uranus, was read by M. Arago. Uranus, when discovered, embarrassed the astronomers by the slowness of its proper motion, and it was a long time before they were all convinced that it was a planet. This first difficulty surmounted, the astronomers were able to ascertain pretty correctly the elements of its ellipsis. At a later period, when a series of observations, embracing a period of from 30 to 40 years, had been made, and when the perturbations due to the action of Jupiter and Saturn had been calculated, they took up the theory developed in the *Mécanique Céleste* of Laplace. The calculations ceased, however, after a time, to agree with the real positions of this planet; and M. Arago thought that there might be some errors in the calculations of Laplace. M. Leverrier has proved that M. Arago was right, and has laid down a new orbit which, for this year, differs by 40 seconds from that of the former calculation. MM. Laugier and Mauvais have shown the identity of the comet discovered in 1844 by M. de Vico, and that of 1785. M. Hind has announced that he has found, in the works of M. E. Biot on the astronomical observations of the Chinese, the necessary documents for calculating the orbit of the comet 1433, and ascertained its identity with the comet of 1780 calculated by Olbers.

Corn Damaged by Sea Water.—A paper was received from Prince Louis Lucien Bonaparte, announcing an observation he has

made on corn spoiled in the holds of vessels by a prolonged contact with sea-water. He has found that it contains large quantities of valerianic and butyric acid. The prince states that he is now occupied with experiments to ascertain the causes under which these two acids are formed.

Compressed Air in Mining Operations.—M. Triger presented an account of the results obtained by him in the recent application of compressed air in mining operations. M. Triger having successfully used compressed air as a means of driving back the masses of water which are found in mines, resolved also to try its effects as a motive power, and states that he has worked an engine with it with great effect, and in situations where there was not room for the operation of a steam engine.

Deep Wells in China.—Some time ago M. Arago read a communication from some of the French missionaries in China, giving an account of some deep wells in that country which had been made by boring. To-day he presented several bottles made of bamboo, containing water (salt) and bitumen taken from these wells, and forwarded for an analysis.

Sand from the bottom of the Artesian Well at Calais.—A letter was received from the Mayor of Calais, requesting that the Academy would order an examination to be made of the sand brought up from the bottom of the Artesian well in that town, at 310 mètres depth, and stating that the indications of the proximity of water were sufficiently encouraging for the work of boring to be proceeded with.

Acids formed of Oxygen, Hydrogen, Azote, and Sulphur.—M. Thénard, in the name of a committee, read a report on the work of M. Frémy, respecting a series of acids formed of oxygen, hydrogen, azote and sulphur. In terminating his report, M. Thénard said, "M. Frémy's paper is full of new and unexpected facts. His labor is one which demanded much sagacity, and if the most numerous and important experiments of M. Frémy had not already given him an elevated rank among chemists, this last work would have entitled him to it. The committee has, therefore, the honor of proposing that the Academy should order his paper to be printed in the 'Recueil des Savans Etrangers.'" This proposition of the committee was adopted.

On the Preservation of Wood.—*Nov.* 24.—M. Arago read a communication from M. Boucherie on preserving wood for building and other purposes. It is now four years since M. Boucherie communicated to the Academy a series of experiments, proving that he had discovered a means of forcing into the pores of wood liquids capable of giving to it great durability and entirely new properties. Since that time many patents have been taken out in France and England for different modes of preserving wood. M. Boucherie's process consists in the introduction of solutions by a sort of filtration. A tub containing the liquid is placed in contact with one end of the wood; the pressure produced by raising the level of the liquid a little above that of the wood, suffices for its perfect impregnation, with the exception of the central part or heart. In the experiments now referred

to, some of these pieces of wood were left in their natural state; others were impregnated to only half their length, and others in the entire length. The liquids used were pyroligneous acid, sulphate of copper, chloruate of pyrolignated calcium, double chlorurate of sodium and mercury. The woods were buried in the ground, at the depth of a few centimètres, in an enclosed yard, at Compiégne, where they remained nearly three years. On taking them up, the prepared wood was found sound, and that which had not been prepared rotten.

Gases held in Solution by Sea Water.— *Dec.* 1—M. Dumas made a communication, in the name of M. Lewy, relative to his experiments as to the composition of the gases held in solution by sea water at different periods of the day. M. Lewy operated upon water taken from the sea at Langreme in the Calvadus. He confirms the experiments made by M. Morreu, with the exception of stating that he has not found the variations so considerable as those announced by that gentleman. The most striking result of M. Lewy's experiments is the augmentation of oxygen during the day, and the diminution of this gas at night, when the sky is clouded, whereas, with the carbonic acid, the result is in the opposite ratio. Sea water, says M. Lewy, contains a notable quantity of sulphuretted hydrogen and hydrosulphate of ammonia. The variations are due to two contrary actions —the action of light on vegetation and animalculæ, and the action of animal matter on the sulphates that are held in solution. In the first case, there is a disengagement of oxygen which increases with the greater or lesser action or the greater or lesser prolongation of solar light; in the second case, there is production of sulphuretted hydrogen, and formation of hydrosulphate of ammonia, which diminish in a remarkable way the proportions of the oxygen dissolved.

Engravings on Ancient Seals.—A paper was received from M. Sichel, giving an account of the engraving on some seals of ancient Roman oculists, which have been recently discovered. It appears that the Roman oculists had engraved upon these seals the names of the remedies for diseases of the eyes which were then in vogue.

Watch for Degrees of Heat and Moisture.—A notice was received from M. Dessagneaux, on a newly-invented watch, which marks the degrees of heat and moisture.

Experiments on Steam.—*Dec.* 15.—A paper by M. Regnault was read relative to his experiments on steam. The Minister of Public Works assisted M. Regnault with the means of making these experiments on an extensive and practical scale. The questions to be settled by M. Regnault, were—1. The law which unites the temperatures and elastic powers of aqueous vapor at saturation. 2. The quantity of heat absorbed by a kilogramme of water at 0 degree, to be converted into steam for saturation at different degrees of pressure. 3. The quantity of heat absorbed by the same quantity of water in order to raise the temperature to the point in which it assumes the state of vapor under different pressures. 4. The specific heat of aqueous vapor at different stages of density, and at different degrees of tempe-

rature. 5. The co-efficients of dilatation of aqueous vapor in different stages of density. In his present paper, M. Regnault gives the law of the elastic powers of steam up to 230 degrees centigrade, which temperature corresponds to 28 atmospheres and a half. He next fixes the total heat of steam taken at different pressures, from 1-5th to 15 atmospheres, and finally, he treats of the calorific capacity of water from 0 to 190 degrees. Many distinguished men have devoted their attention to the elastic powers of steam. We may mention Achard, Greu, Dalton, Christian, Araberger, Watt, Robinson, Bétancourt, Schmidt, Southern, Ure, Gay-Lussac, August, Kaemtz, Dulong, and Arago, the two latter of whom commenced their experiments in 1823, at the request of the Minister of the Interior, and published an account of them in 1829. They carried their operations up to 25 atmospheres. About the same period a commission of scientific Americans performed a series of experiments on this subject, but went up to only 10 atmospheres. The results, however, of these different experiments were not alike, consequently, M. Regnault had to take entirely new ground, greatly aided, however, by the progress which science has made since the period alluded to. In his results he agrees most with MM. Dulong and Arago, particularly as regards high rates of pressure. Watt had supposed that the total quantity of heat necessary for the transformation of a kilogramme of water into the state of steam was certain under a constant pressure. The number admitted was 650. This law, although not exemplified by any precise experiment, had been until very lately regarded as positive, and so adopted in theory and practice. M. Regnault, however, has ascertained that this number increases constantly from 622 under the pressure of one-fifth of an atmosphere up to 670 under 15 atmospheres. At the ordinary pressure the average of 38 experiments gives 636-37. As to the calorific capacity of water, it is 1000 between 0 and 30 degrees, 1005 between 30 and 120, 1013 between 120 and 190.

Temperature of Artesian Well at Neuffen.—A paper was received from M. Daubrée, relative to the high rate of temperature in an artesian well, at Neuffen, in the kingdom of Wurtemburg. The Count de Mandelslohe, says M. Daubrée, has ascertained in this well a more rapid increase of temperature with the depth than has ever yet been witnessed in any other locality. In most of the artesian wells it has been found that the temperature increased about one degree for every 30 mètres, but at Neuffen the increase has been one degree for every 10 mètres. The depth of the well is 385 mètres, and the temperature at the bottom is 38 deg. 7 min. of Centigrade (about 104 of Fahrenheit.) The nearest approach to this great exception from the normal state of things is at Monte Marin, in Tuscany, and it is worthy of remark that in both cases the bottom of the well is still 35 mètres above the level of the sea. M. Daubrée thinks that the cause of these anomalies is the ancient heat of the ignitial rocks, which being very slow conductors of heat communicate but a small portion of it to the surrounding strata.